Phase I Remedial Investigation
Pasco Landfill
Pasco, Washington

Volume IV - Health and Safety Plan

November 1992

Prepared for:

Pasco Landfill PLP Group

Project 624419

Prepared by:

BURLINGTON ENVIRONMENTAL INC.
Technical Services Division
7440 West Marginal Way South
Seattle, Washington 98108-4141
(206) 767-3306

Printed on recycled paper

SITE HEALTH AND SAFETY PLAN
PASCO LANDFILL
PASCO, WASHINGTON

APPROVAL PAGE

Date Issued: October 16, 1992

Approved by: _____
David Haddock
Project Manager
Burlington Technical Services

Approved by: _____
Frank Gardner
Burlington Health and Safety Officer

Approved by: _____
Craig Maxeiner
Burlington Site Safety Officer

ABSTRACT

The Phase I Remedial Investigation Work Plan for the Pasco Landfill in Pasco, Washington describes the various steps or phases essential to the investigation process and defines the activities that the Pasco Landfill Potentially Liable Party Group proposes to conduct during this investigation. This Phase I Remedial Investigation will be completed under an Agreed Order with the Washington Department of Ecology (Order No. DE92TC-E105) and in compliance with the Model Toxics Control Act (Chapter 70.105D RCW and Chapter 173-340 WAC).

The objective of this investigation is to gain additional information on the nature and extent of contamination in the air, soil, and groundwater near potential contaminant sources at the Pasco Landfill. A Preliminary Risk Assessment will also be completed. This Work Plan describes the various steps proposed for gathering the necessary site characterization information and data and for performing the Preliminary Risk Assessment.

As Part of the Work Plan, a Sampling and Analysis Plan (Volume II), a Data Management Plan (Volume III), a Health and Safety Plan (Volume IV), and a Public Participation Plan (Volume V) have been developed for the performance of this project. Completion of the work defined in these planning documents will be followed by a Phase II Remedial Investigation (if necessary) and a Feasibility Study. The Washington Department of Ecology will determine the need for remedial action based partly on the findings from the Remedial Investigation and Feasibility Study.

SITE HEALTH AND SAFETY PLAN SUMMARY

Site:	Pasco Landfill
Location:	Approximately 1.5 miles northeast of Pasco, Washington
Proposed Dates of Investigation:	October, November, December 1992
Duration of Investigation:	8 weeks, 10-hour days, including weekends
Type/Status of Site:	Closed, inactive industrial waste disposal facility and active solid waste landfill
Size of Site:	Approximately 250 acres
Land Use of Area Surrounding Facility:	Rangeland and irrigated cropland
Factors Prompting Investigation:	Low concentrations of metals and chlorinated organic compounds detected in groundwater
Contaminant Types:	Chlorinated organic compounds, metals
Chemical Hazards:	Inhalation and skin contact
Physical Hazards:	Heat or cold stress, drilling, and RECON® hazards, including noise
Levels of Protection:	The minimum level of protection is Level D for non-intrusive activities. Intrusive activities will be performed in modified Level D. Elevated concentrations of organics and/or airborne dust may necessitate upgrading to Level C, with Level B contingency
Air Monitoring Equipment:	Flame ionization detector, photoionization detector, CGI, H_2S Monitor, and personal sampling pump
Factors Prompting Monitoring:	Documented concentrations of organic compounds in groundwater
Primary Emergency Contact:	Our Lady of Lourdes Health Center 4th Street and Sylvester Pasco, Washington (509) 546-2201 or 911
Site Access:	Emergency Site Access: (509) 547-4802

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 PURPOSE

This Site Safety Plan establishes policies and procedures to protect Burlington Environmental Inc. (Burlington) personnel from the potential hazards posed by fieldwork during the Phase I Remedial Investigation (RI) at the Pasco Landfill site. The Health and Safety Plan provides measures to minimize potential exposure, accidents, and physical injuries that may occur during daily on-site activities and during adverse conditions. It also provides contingencies for emergency situations.

This plan must be observed by all Burlington employees and subcontractors (together referred to as Burlington personnel) participating in the fieldwork. Medical surveillance, personal protection, respirator fit test, and hazardous waste operations training requirements according to OSHA 29 CFR 1910.120 and WAC 296-62 shall be met by all personnel working in the control zone at this site. All observers present during these activities must also comply with all safety requirements of the plan. To help ensure safety compliance, all Burlington field participants and observers must read this plan and sign a certification stating that they agree to comply with all the plan conditions.

2 KEY MANAGEMENT/HEALTH AND SAFETY PERSONNEL

Efficient on-site operations require that key personnel be identified and that their roles, responsibilities, and scope of authority be clearly defined.

Mr. David Haddock is the Burlington Technical Services Project Manager for the Pasco Landfill RI and will be responsible for project oversight.

Mr. Ted Wall is the Assistant Project Manager and will be responsible for project oversight in Mr. Haddock's absence.

Mr. Craig Maxeiner is the Site Supervisor and Site Safety Officer and will be responsible for all site operations. He will have the primary responsibility for ensuring implementation of the personnel health and safety policy, correcting improper conditions, and following safety practices. Mr. Maxeiner will be responsible for providing management support, enforcement, and allocation of necessary resources to assure implementation of the sampling plan. He will also be responsible for implementing this safety plan, will establish the control zone for each field effort, and will act to correct safety deficiencies. He will notify the Health and Safety Officer prior to modifying any safety procedures detailed in this plan. As Site Safety Officer, he has authority to temporarily suspend site operations. Operations may resume only after appropriate actions have been developed through consultation among the Project Manager and the Health and Safety Officer.

Mr. John Dolan is the Assistant Site Safety Officer and will be responsible for implementation of personnel health and safety policy, correcting improper conditions, following safety practices, and all other Site Safety Officer Responsibilities.

Mr. Frank Gardner is Burlington's Health and Safety Officer. His responsibilities will be to review and approve the Health and Safety Plan and any subsequent changes to the plan. In addition, he will provide technical support to the Site Safety Officer as needed. If warranted, he will conduct site safety audits to ensure that the Health and Safety Plan is being implemented correctly.

3 FIELD INVESTIGATION

This section summarizes the Phase I RI Work Scope, and provides a brief site description and history summary. Also included are anticipated hazards, levels of personal protection required, field monitoring procedures, a description of site control and safe work practices, and personal and equipment decontamination protocols.

3.1 Scope of Work

The following field tasks will be accomplished during the field effort at the Pasco Landfill:

- initial site "walkover" air quality survey (this task was completed on October 6, 1992);
- soil-gas sampling;
- borehole drilling and soil sampling;
- installation of groundwater monitoring wells;
- installation of landfill gas probes;
- groundwater quality sampling;
- surface soil sampling;
- geophysical surveying
- sampling location surveying;
- decontamination of personnel and equipment;
- monthly water elevation measurements; and
- aquifer pump testing.

3.2 Site Description and History

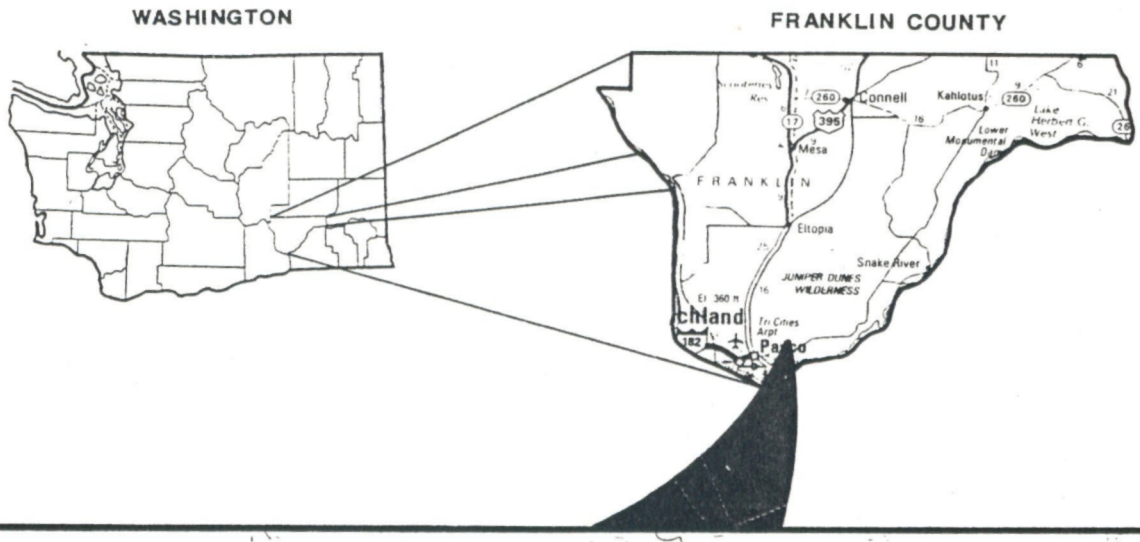
The Pasco Sanitary Landfill is an active, operating sanitary landfill and currently occupies a 250-acre site consisting of gently rolling hills surrounded by rangeland and irrigated cropland. The climate of the area is arid. The site is located approximately 1.5 miles northeast of the city of Pasco, Washington, and about 3 miles north of the confluence of the Snake and Columbia Rivers as shown in Figure 1.

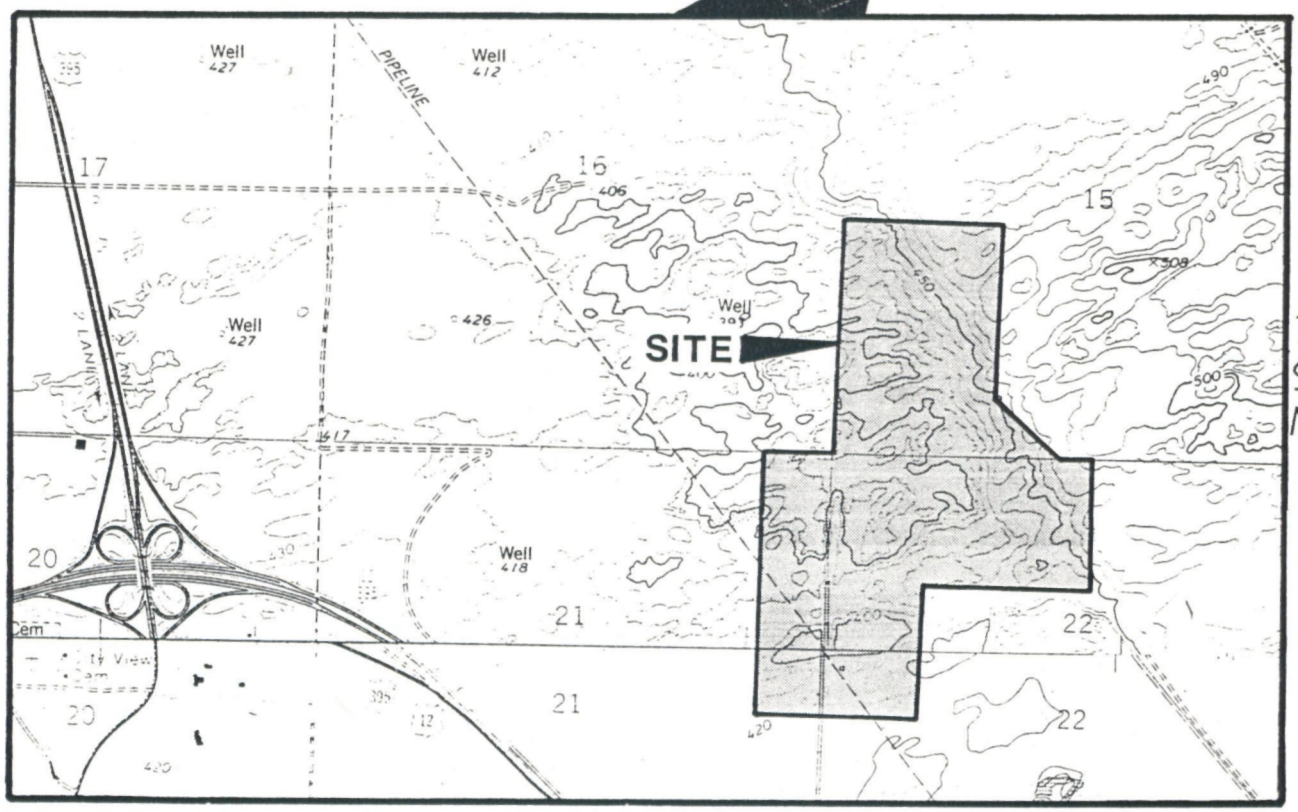
The site was operated from 1958 to 1971 in conformance with accepted practices as an open burning facility. In 1971, the site was converted into a sanitary landfill. In 1974, the landfill began accepting septic wastes for open pit evaporation and disposal. The facility currently receives municipal solid waste from Benton, Franklin, and Walla Walla Counties.

Part of the Pasco Landfill site was developed as an industrial waste disposal facility that operated from late 1972 through 1974, accepting primarily bulk sludges and drummed wastes. Industrial wastes were segregated into five zones at the facility designated Zoned A, B, C, D, and E. The locations of these zones and other landfill "potential source areas" are shown on Figure 2. Table 1 lists industrial wastes disposed in the zones.

The industrial part of the facility was closed in early 1975. Closure of the industrial disposal facilities included moving some wastes to polyethylene-lined trenches and covering all zones with a composite cap of 3 feet of soil, 4-mil polyethylene sheeting, and an additional 2 feet of soil.

DRAWN BY	CHECKED BY	DOCUMENT MANAGER	PROJECT MANAGER
BB 10/15/92			





R. 30 E.

SCALE IS VARIABLE

N

Modified from U. S. Geological Survey Glade and Pasco, Washington quadrangle, photorevised 1973 and 1979.

Burlington Environmental Inc.

SITE LOCATION MAP

PASCO LANDFILL
PASCO, WASHINGTON
624419

FIGURE 1

	DRAWN BY	CHECKED BY	DOCUMENT MANAGER	PROJECT MANAGER
A REV. DATE 10/14/92	BB 10/15/92	BMO 10/15/92	10/22/92	10/22/92

MW-10
MW-11
MW-12
MW-12I
MW-12D
MW-17
MW-17I
MW-17D
MW-15
MW-13
EE3
EE2
MW-14
ZONE A
WATER SUPPLY WELL
LFG-1
LFG-2
MW-16
MW-18
EE7
B-1
EE6
ZONE C
B-2
ZONE D
MW-19
INACTIVE BURN/BALEFILL
SLUDGE AREA BOUNDARY
PERMITTED WASTE BOUNDARY
SOLID WASTE LANDFILL
B-3
EE9
EE8
ZONE E
B-4
B-5
EE5
EE4
B-6
ZONE B
MW-20
B-7
B-8
SEWAGE LAGOON
MW-21
MW-21I
MW-21D
CONTROL
EE1
BACKGROUND
B-9
B-10
SITE BOUNDARY

EXPLANATION

- ●EE2 — WELL NUMBER AND APPROXIMATE LOCATION
- ○B-3 — PROPOSED SOIL BORING AND NUMBER
- ▲LFG-1 — PROPOSED LANDFILL GAS PROBE AND NUMBER
- ⊕MW-10 — PROPOSED MONITORING WELL LOCATION AND NUMBER
- SURFACE SOIL GRID SAMPLING AREA AND SAMPLING POINTS

0 400 800
SCALE IN FEET

N

Burlington Environmental Inc.

PROPOSED MONITORING WELLS, BORINGS, AND SURFACE SOIL TESTING AREAS

PASCO LANDFILL
PASCO, WASHINGTON
624419

FIGURE 2

Table 1
WASTE QUANTITIES AND BURIAL LOCATION
PASCO LANDFILL
PASCO, WASHINGTON

Location	Dimensions Lining	Waste Types	Estimated Quantity	Units
Zone A	250' x 150'	Acids	544	drums
		Aromatic Tars	160-248	drums
	bottom unlined	Carcinogenics (unspecified)	9	drums
	top lined	Caustics	8,744	drums
		Cadmium	11	drums
		Metal Finishing	244-304	drums
		Oil Sludge	433	drums
		Paint	10,258-24,200	drums
		Pesticides	425	drums
		Pesticide Containers (empty)	791-863	drums
Zone B	85' x 85'	2,4-D Manufacturing	2,011-5,080	drums
	bottom unlined			
	top lined			
Zone C	110' x 110'	Acids	7,000	drums
		Acid Metal Cleaning	2,301,560	pounds
	bottom unlined	Lime Phenol	684,967	gallons
	top lined	Metal Cleaning	185,162	gallons
		Metal Finishing	17,000-35,724	gallons
			1,460,602-1,949,652	pounds
Zone D	105' x 105'	Aromatic Tar	499,270	pounds
		Cutting Oil	76,350-84,300	gallons
	bottom unlined	Fertilizer Manufacturing	288,288	pounds
	top lined	Oily Sludge	6,000-66,340	gallons
		Paint	72,475-497,418	pounds
		Paint	66,516-95,711	gallons
		Plywood Resin	1,393,380-2,215,440	pounds
		Solvents	12,648	gallons
Zone E	180' x 180'	Chlor-Alkali Sludge	10,500-11,582	tons
	bottom and top lined			
Unknown		Acid Sludges	1,000	gallons
		Acid Wash Solution	312,350	pounds
		Benzoic Acid and Tar	176,000	pounds
		Chemistry Lab Reagents	1	drum
		Chrome Rinse Water	700,901	pounds
		DCP Tar	8,790	gallons
		Etching Solution	1,914	barrels
		Lime Sludge	80-160	drums
		MCPA Bleed	104,318-327,000	gallons
		MCPA Tar	2,965-3,307	drums
			939	drums
			2,813	barrels
			680	pails
		Metal Casing Wastes	3,300-5,760	drums
		Misc. Lab Chemicals	29	small containers
		NH_4+ and NaOH Chemical Solns.	17,238	gallons
		Oily Sludge	116,680	pounds
		Miscellaneous	435	drums
		Pesticide Containers	1,045	each
		Resin Manufacturing	392,553	gallons
		Solid Caustic Soda	44,550	pounds
		Wood Treatment/Preservative	238	drums
		Sludges	294,662	gallons

Source: E&E, 1986.

Note: The waste inventory in unknown locations may be duplicated in the inventory of Zones A through E. This inventory was prepared by E&E and has not been independently verified.

The site was investigated during operation and after closure of the industrial area. Beginning in 1982, groundwater monitoring wells were installed and have been monitored since 1986.

As part of the U.S. Environmental Protection Agency's (EPA) nationwide dioxin investigation, the site was investigated in 1984. This site was included because of known pesticide wastes buried there. No dioxin contamination or other organic contaminants were identified in the water at that time. Ecology and Environment (E&E) performed another site investigation in 1985. E&E's report was completed in June of 1986 and identified several volatile organic compounds (VOCs) present in groundwater at three monitoring wells. They concluded that trace amounts of contaminants may have migrated outside of burial Zones A, C, D, and E. No evidence of contamination migration from Zone B was found. The report states: "Groundwater contamination by organics occurred only beneath or adjacent to the former municipal disposal and burn area...".

The facility is underlain by unconsolidated and consolidated sediments of the Touchet Sands, Pasco Gravels, Ringold Gravels, and Ringold Clays. These sediments are estimated to be approximately 140 feet thick at the site and overlie a thick sequence of Columbia River Basalts.

Groundwater beneath the landfill area first occurs in the Pasco Gravels with depths to water ranging from about 40-75 feet. Groundwater flow is to the southwest.

3.3 Hazards

3.3.1 Chemical

Chemical hazards on site would be from three potential sources: 1) buried waste materials from previous disposal activities; 2) groundwater contamination from subsurface

migration of buried wastes and gaseous by-products; and 3) chemical supplies used by field personnel during on-site RI activities. Hazard potential would vary depending on the specific task and work activity. Figure 2 shows the proposed locations of soil sampling points, monitoring wells, soil borings, and landfill-gas probe sites in relation to the operable units identified at the landfill.

The principal chemical hazards associated with this project area result from potential contact with trace concentrations of toluene, xylene, chlorinated organic compounds, and heavy metals from the subsurface. These chemicals may pose respiratory, ingestion, and dermal contact hazards and are known or suspected to be carcinogenic, mutagenic, or toxic. In addition, dermal contact with unearthed buried waste material may pose an irritant hazard to skin and eyes if the waste has a caustic pH level.

Skin and eye contact and inhalation of organic vapors are the significant routes of exposure during sampling and well installation activities. Effects include central nervous system depression with symptoms such as dizziness, drowsiness, headache, fatigue, muscular weakness, and lack of coordination. Accidental ingestion may also occur through inadequate decontamination procedures or personal hygiene practices.

Groundwater contamination has been detected beneath the site. Significantly different parameters have been detected in the general area downgradient from Zone A and the Balefill/Burn area than those associated with the other on-site landfill operable units. Wells 1, 2, EE-2, EE-3, and EE-6 had contaminant levels in excess of the EPA Maximum Contaminant Level (MCL) specified limits. Metals, specifically total and dissolved iron and manganese, were detected above MCL limits.

Several VOCs were also detected in groundwater, mainly associated with Zone A and the Balefill/Burn operable unit. Wells 2, EE-2, and EE-3 contained the following six VOCs above EPA MCL levels: vinyl chloride at 612.11 ppb; 1,1,1-trichloroethane at 974.51 ppb; trichloroethylene (TCE) at 1,006 ppb; tetrachloroethene (PCE) at 59.8 ppb; toluene at 1,262.43 ppb; and total xylenes at 641.52 ppb. These concentrations are the maximum detected over the period of monitoring. These solvents are similar to those found in other municipal solid waste

landfills. Chlorinated solvents are typically components of cleaners and degreasers and have been associated with dry cleaning outlets and print shops that may have disposed of residue containing these contaminants. In summary, the majority of the wells monitoring the Pasco Landfill Facility indicate no significant variations from background concentrations. Monitoring wells located downgradient from Zone A and the inactive Balefill/Burn area show the greatest impact.

Landfill gases, predominately methane, may pose the greatest chemical hazard to on-site field operation. Sanitary (solid waste) landfills commonly generate gaseous by-products from decomposition of organic wastes. Methane usually accumulates as a flammable hazard and hydrogen sulfide (H_2S) is commonly present as a toxic hazard. These gases, if present in significant quantities, could pose a potential hazard to drilling, probing, and sampling activities that penetrate the sanitary landfill cell or porous geologic media in close proximity to the waste cell. Installation of the gas probes or monitoring wells along the western boundary of the waste cell would be the most hazardous task with respect to encountering landfill gases. Specific information on chemical hazards, including exposure limits and symptoms of overexposure, are presented in Table 2.

The Phase I RI activities by field personnel will be conducted on and around an active sanitary landfill. Some of the activities may be in areas potentially impacted by landfill operations and therefore, would be subject to requirements of the facility's safety plan. The field team must abide by the Pasco Landfill Safety Plan (Appendix A) and must coordinate with facility management to be mutually informed and aware of correct actions to take during on-site field operations.

Table 2

HEALTH EXPOSURE SUMMARY

PASCO LANDFILL
PASCO, WASHINGTON

HAZARD	HEALTH HAZARD RATING AT THIS SITE	ROUTE OF ENTRY	SYMPTOMS OF OVEREXPOSURE	FIRST AID
Chromium (possible)	Very low: due to expected concentrations at the site.	Inhalation, ingestion, contact.	Inhalation: coughing, wheezing, headache, dyspnea, pain on deep inspiration, fever, and loss of weight.	Eye contact: irrigate immediately. Skin contact: wash with soap and water. Inhalation: move immediately to fresh air. Perform artificial respiration as required. Ingestion: induce vomiting by administering large volumes of water. Seek medical attention.
Cold Stress	Medium: due to environmental conditions during cold weather sampling.	Contact, inhalation.	Hypothermia- shivering, numbness, lowered body temperature, drowsiness, and muscular weakness, sometimes resulting in death.	Remove cold, wet clothing. Warm victim by wrapping in blankets or placing in tub of warm water. Administer hot, nonalcoholic liquids.

Table 2
HEALTH EXPOSURE SUMMARY (continued)

PASCO LANDFILL
PASCO, WASHINGTON

HAZARD	HEALTH HAZARD RATING AT THIS SITE	ROUTE OF ENTRY	SYMPTOMS OF OVEREXPOSURE	FIRST AID
Heat stress	High: during elevated environmental temperatures.	Contact.	Heat rash; heat cramps; heat exhaustion (pale, clammy skin; profuse perspiration; weakness; headache; nausea); heat stroke (hot, dry skin; high fever; dizziness; nausea, rapid pulse; and unconsciousness).	Remove protective clothing; take temperature; cool off with a watery spray; have employee slowly drink 8 oz. of cool water, diluted, unsweetened fruit juice or Gatorade; have employee rest until oral temperature is less than 99°F. If body temperature > 100°F, seek medical attention.
Lead (possible)	Very low: due to expected concentrations at the site.	Inhalation, ingestion, contact.	Fatigue, sleep disturbance, headache, aching bones and muscles, abdominal pains, decreased appetite (flu-like symptoms).	Eye contact: irrigate immediately. Skin contact: wash with soap and water. Inhalation: move immediately to fresh air. Perform artificial respiration, as required. Ingestion: induce vomiting by administering large volumes of water. Seek medical attention.

Table 2

HEALTH EXPOSURE SUMMARY (continued)

PASCO LANDFILL
PASCO, WASHINGTON

HAZARD	HEALTH HAZARD RATING AT THIS SITE	ROUTE OF ENTRY	SYMPTOMS OF OVEREXPOSURE	FIRST AID
Noise	Medium/High: when exposed to operations generating high sound pressure levels (e.g., drilling operation and portable generators). Contact limited by use of hearing protection.	---	Stress, tensing of muscles, headache, temporary or permanent hearing loss.	Remove from noise source.
Chlorinated Solvents	Low: due to concentrations expected.	Inhalation, ingestion, contact.	Inhalation: loss of coordination, irritation to eyes, nose, throat. Ingestion: nausea, loss of coordination, throat irritation. Contact: skin dehydration and redness.	Inhalation: move to fresh air and apply artificial respiration if necessary. Ingestion: have victim drink water and induce vomiting. Eyes: flush thoroughly with water. Skin: remove contaminated clothing and wash exposed area with water and soap.

Table 2
HEALTH EXPOSURE SUMMARY (continued)

PASCO LANDFILL
PASCO, WASHINGTON

HAZARD	HEALTH HAZARD RATING AT THIS SITE	ROUTE OF ENTRY	SYMPTOMS OF OVEREXPOSURE	FIRST AID
Xylene	Low: due to expected concentrations.	Inhalation, ingestion, contact.	Inhalation/ingestion: dizziness, staggering, drowsiness, unconsciousness, nausea, vomiting, and abdominal pain. Contact: skin, eye, nose, and throat irritation. A skin and eye irritant (mutagenic). Acts on the central nervous system affecting mental processes. Absorbed somewhat through skin. Exposure symptoms: up to 200 ppm, few symptoms; at 200 to 500 ppm, headache, nausea, eye irritation, loss of appetite, a bad taste, listlessness and confusion, weakness, loss of coordination with apparent effects of intoxication (euphoria); at 500 ppm and greater, intoxication effects are greater and more rapid up to a narcotic state, possible to coma. Acute poisoning is rare. Recovery usually follows removal from exposure. Skin exposure causes tingling or "crawling" sensation and rash.	Eye contact: irrigate immediately. Skin contact wash with soap and water. Inhalation: move immediately to fresh air. Perform artificial respiration as required. Ingestion: seek medical attention. Do not induce vomiting.

Table 2
HEALTH EXPOSURE SUMMARY (continued)

PASCO LANDFILL
PASCO, WASHINGTON

HAZARD	HEALTH HAZARD RATING AT THIS SITE	ROUTE OF ENTRY	SYMPTOMS OF OVEREXPOSURE	FIRST AID
Toluene	Low: due to expected concentrations.	Inhalation, ingestion, contact.	Inhalation/ingestion: dizziness, staggering, drowsiness, unconsciousness, nausea, vomiting, and abdominal pain. Contact: skin, eye, nose, and throat irritation. A skin and eye irritant (mutagenic). Acts on the central nervous system affecting mental processes. Absorbed somewhat through skin. Exposure symptoms: up to 200 ppm, few symptoms; at 200 to 500 ppm, headache, nausea, eye irritation, loss of appetite, a bad taste, listlessness and confusion, weakness, loss of coordination with apparent effects of intoxication (euphoria); at 500 ppm and greater, intoxication effects are greater and more rapid up to a narcotic state, possible to coma. Acute poisoning is rare. Recovery usually follows removal from exposure. Skin exposure causes tingling or "crawling" sensation and rash.	Eye contact: irrigate immediately. Skin contact wash with soap and water. Inhalation: move immediately to fresh air. Perform artificial respiration as required. Ingestion: seek medical attention. Do not induce vomiting.

3.3.2 Physical

Physical hazards offer the highest risk to health and safety. The site is an active, operating waste hauling/disposal facility and large trucks are in use. Therefore, clear communication and coordination between field personnel and facility operations management is essential. All parties must know how their respective activities may impact each other.

Physical hazards directly associated with this fieldwork include disturbance of underground utilities during drilling and RECON® operation; eye and skin contact hazards during sampling and well and gas probe drilling; heat stress; and possible cold stress during wintertime sampling activities.

3.3.2.1 Drilling Hazards

Electrical cables, gas lines, water lines, and unknown objects may be located under proposed drilling/probing sites in the immediate vicinity of the buildings for the landfill facility. A physical survey must be conducted to identify utility lines and pipes and to detect buried objects if utilities are thought to be within 100 feet of a penetration site. The identified locations of buried utility lines will be clearly marked for field personnel.

Burlington personnel will monitor for organic vapors during all drilling activities except drilling performed in locations for background definition. Eye and skin contact from contaminated water and soil or other projectiles is also of concern during drilling. Safety glasses with side shields will be required for protection from potential eye injury.

Burlington's Hazard Communication Program (Health and Safety Operating Procedure H&S 221) must be implemented on the site to protect field personnel, especially non-employees, from potential hazards associated with the use of our field chemical supplies. As a minimum, a Material Safety Data Sheet (MSDS) will be available for each chemical brought on site, and a copy will be provided, upon request, to management of the facility, the drilling contractor, and

other organization (represented on site) that may be adversely impacted by the presence or use of our chemical supplies. Contractors will be required to submit copies of MSDSs for their on-site chemical supplies. Field personnel must be prepared to contain on-site spills of their chemicals.

3.3.2.2 Heat Stress

When Burlington personnel encounter temperatures above 70° F, they should be aware of heat stress precautions. Personnel who must wear protective clothing while working in warm temperatures are subject to heat-induced physiological stress since little evaporative cooling can occur. Heat stress can result in minor symptoms such as heat rash and heat cramps or severe effects such as heat exhaustion and heat stroke. Heat rash is a skin irritation resulting from prolonged contact with wet clothing. It can be prevented by allowing the skin to dry completely during rest periods and by showering at the end of the work day. Heat cramps, heat exhaustion, and heat stroke all result from the excessive loss of body fluids and electrolytes. The symptoms of heat cramps are spasms in the abdomen or limbs. Heat exhaustion results from more severe dehydration. Symptoms include pale, clammy skin; profuse perspiration; weakness; headache; and nausea. Heat stroke is a life-threatening condition that occurs when the body's temperature-regulating system no longer functions properly. Symptoms include hot, dry skin; a high fever (often 106°F or more); dizziness; nausea; rapid pulse; and unconsciousness. Brain damage and death may follow if the body temperature is not reduced. All personnel should be familiar with the symptoms of heat stress and appropriate first aid and precautionary measures. The proper work regimen, adequate fluid intake, and electrolyte replacement are vital in the prevention of heat stress.

In temperatures of 70° F and above, the following provides guidance for a work/rest regimen for personnel wearing Level C protection:

- 70° to 85°F - workers should not be allowed to work more than 1 hour without at least a 15-minute break.

- 85° to 95° F - workers should not be allowed to work more than 45 minutes without at least a 15-minute break.

- Exceeding 95° F - workers should not be allowed to work more than 15 minutes without a 15-minute break. If extreme temperature conditions are encountered, consideration should be given to rescheduling work for the cooler morning or evening hours.

3.3.2.3 Cold Stress

During the proposed dates of fieldwork, the site may be subject to low temperatures, rain, and winds. Care must be taken to limit cold exposure by providing proper protective clothing, access to warm shelter, and a temperature-dependent work regimen limiting periods of outdoor activity.

Cold stress can be manifested as hypothermia. Hypothermia is a cold-induced decrease in the core body temperature that produces shivering, numbness, drowsiness, muscular weakness, and if severe enough, death. All personnel should be familiar with the symptoms of cold stress and appropriate first aid measures.

3.4 Levels of Protection and Safety Equipment

Protective clothing is necessary to prevent contact with potentially hazardous concentrations of chemical agents. The minimum protective clothing requirements by activity or location are as follows:

- all on-site nonintrusive activities in surface-clean locations, excluding contamination, and all work in locations for background definition - Level D;

- sampling with the RECON System and sampling of all media in locations not specifically listed below as requiring greater dermal protection - minimum modified Level D;

- all work in locations believed or suspected to be surface-contaminated, drilling and sampling in all site locations except those for background definition, and decontamination activities - full modified Level D; and

- any work activity on any on-site location where air quality monitoring indicates a probability of inhalation hazard - Level C or Level B (as appropriate).

Note: Due to the possibility that substantial organic vapors may be encountered during drilling, water-level measuring, groundwater sampling, or landfill gas sampling, Level C will be required initially, until monitoring as described in Section 3.5.2 demonstrates that organic solvent vapors are not significant.

Specific protective clothing and safety equipment requirements are summarized in Table 3. If contaminants present a health risk as defined in Table 4, personal protective clothing may need to be upgraded.

Table 3

REQUIRED PROTECTIVE CLOTHING AND SAFETY EQUIPMENT

PASCO LANDFILL
PASCO, WASHINGTON

LEVEL D (Minimum OSHA Work Place Requirements)

Protective Clothing

- Standard work clothing with long sleeves and pant legs
- Heavy work gloves (as needed)
- Steel toe, steel shank boots
- Safety glasses with side shields
- Hard hat

Safety Equipment

- Eyewash
- First aid kit
- Portable fire extinguisher (minimum, 10#, type A-B-C)

MODIFIED LEVEL D (In addition to that listed for Level D)

Protective Clothing

- Minimal
  - Nitrile or PVC heavy-duty rubber (not surgical) gloves

- Full
  - Goggles
  - Inner surgical gloves
  - Nitrile or PVC heavy-duty rubber gloves
  - Rubber boots (neoprene or butyl)
  - Rubber boot covers (to minimize decontamination)
  - Plain Tyvek coveralls

    or

    Polyethylene (poly)-coated Tyvek coveralls (for splash protection, when contamination is visible or causes needle deflections with the Photoionization detector (PID) (when measuring sample headspace or cuttings)

Note: Upgrade to saran-coated (saranex) coveralls (duct-taped at wrists and ankles) and full-face shield if handling chemical waste material, such as visible sludge.

Table 3, Continued

REQUIRED PROTECTIVE CLOTHING AND SAFETY EQUIPMENT

PASCO LANDFILL
PASCO, WASHINGTON

MODIFIED LEVEL D, Continued

Safety Equipment

- FID
- PID
- CGI
- H_2S monitor
- Eyewash
- Personal sampling pumps
- Calibrator
- Collection media (heavy metals, organic vapors, etc.)

Respiratory Protection

- Based on air quality monitoring instrument readings
- Must be MSHA/NIOSH-approved and properly fit-tested to the individual

LEVEL C

- Full-face air-purifying respirator equipped with dual-combination organic vapor and gas and high-efficiency particulate and aerosol-filtering cartridges

LEVEL B (contingency)

- Full-face, positive-pressure, pressure-demand air-supplying respirator equipped with certified breathing air quality (CGA Grade D, minimum) air supply with a five-minute (minimum) self-contained air supply cylinder for emergency levels.

Table 4

DECISION CRITERIA FOR UPGRADING OF PERSONAL PROTECTIVE EQUIPMENT

PASCO LANDFILL
PASCO, WASHINGTON

	Measurement	Action and Protective Equipment
A. Gases and Vapors		
1. Organic Survey Mode	> Background to ≤ 5 ppm above background	Monitor contaminant level in or near breathing zone of workers. Level C protection.
	> 5 ppm to 500 ppm	Upgrade protection to Level B, obtain further information, GC/MS analyzed sorbent samples.
	> 500 ppm to 1000 ppm	Stop work and seek assistance.
2. Combustible Gas	> 5% LEL	Requires continuous, as practical, monitoring.
	< 10% LEL	Limit activities in area to those that do not generate sparks, non-sparking tools and gear, investigate source of combustible gas.
	> 10% LEL	Limit all activities in area, stop work activities.
3. Oxygen Level	< 19.5%	Monitor while wearing SCBA.
	19.5 - 25%	Continue measurements with respiratory protection equipment based on other factors such as the presence of toxic air contaminants.
	> 25%	Fire hazard potential exists, stop work activities.
4. H_2S	10 ppm	Upgrade to Level B.
B. Particulate Level and Dust Control	> Background to 2mg/m³	Modified Level D
	> 2 to ≤ 10 mg/m³	Modified C or Level C Protection. Air purifying respirator should be equipped with high efficiency/organic vapor/acid gas combination cartridges. Basic dust control techniques will be used for all intrusive activities.
	> 10 to ≤ 20 mg/m³	Upgrade to Level B Protection. Collect air sample information.
	> 20 mg/m³	Stop work and seek assistance.

LEL - Lower explosive limit
mg/m³ - Milligram per cubic meter
ppm - Parts per million
% - Percent

3.5 Field Monitoring Requirements

3.5.1 Initial Monitoring

On October 6, 1992, field monitoring was conducted during initial site entry to meet the following objectives:

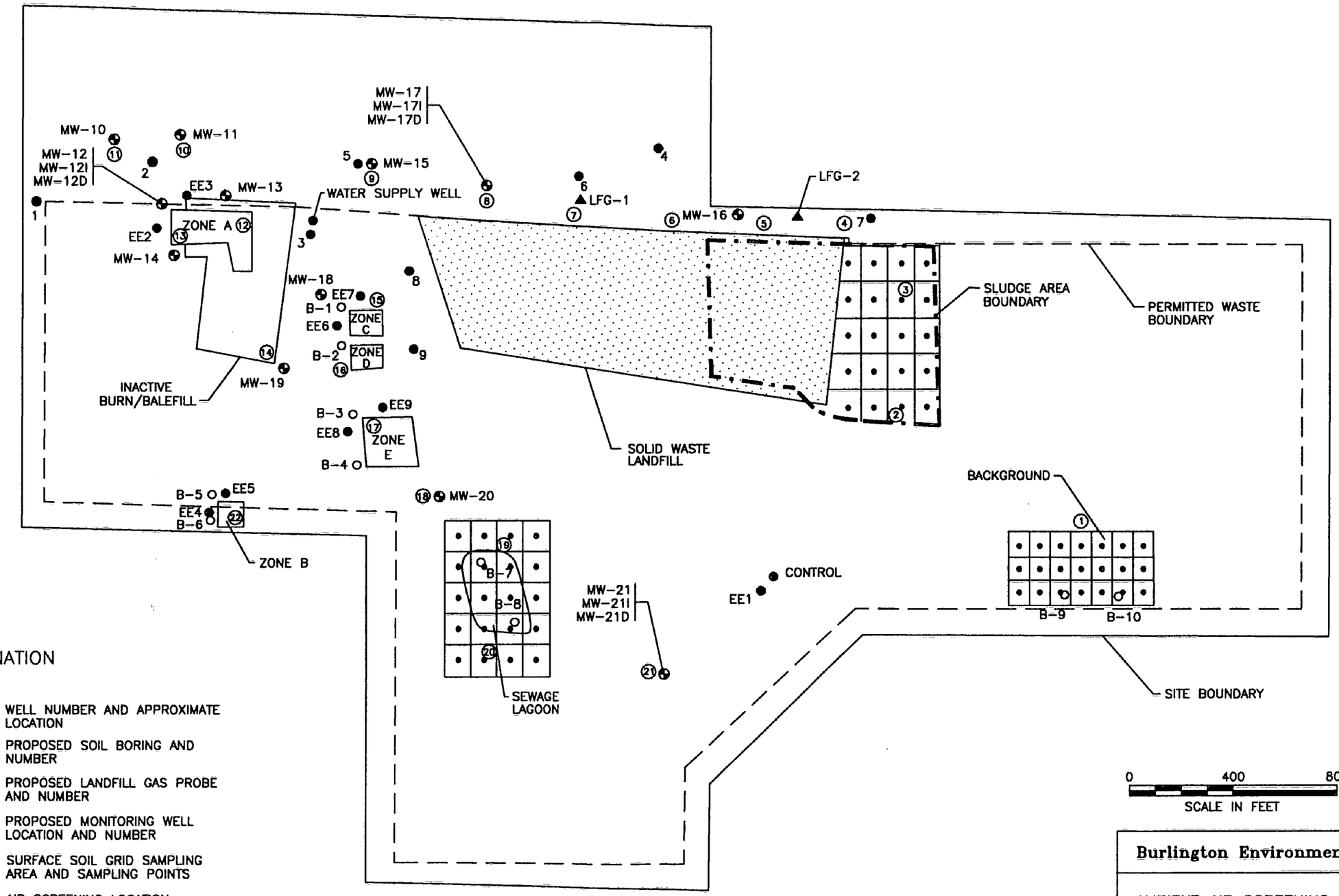
- Evaluate existing or potential hazards that may affect personnel performing the work tasks.
- Verify existing information and gather additional site-specific environmental data.
- Collect supplemental information to evaluate the safety requirements for personnel entering the site.

During the initial site "walkover", an air quality survey was conducted as the preliminary survey in accordance with 29 CFR 1910.120(c)(2) and (5)(iii). This walkover was completed on foot and in a vehicle. The main focus of the initial monitoring was to rapidly identify immediate hazards and evaluate background concentrations. Monitoring instrumentation for this task included a photoionization detector with a 11.7-eV lamp, and a combination combustible gas/hydrogen sulfide/oxygen meter.

Ambient air screening with these instruments was completed at 22 locations on the site. With the exception of the background location, this screening was completed in the vicinity of the various potential source areas. Figure 3 shows the sample locations and Table 5 shows the ambient air screening results. The data presented in Table 5 do not indicate a significant ambient air hazard associated with the site at the time of the sampling. These data will be used as baseline information for the upcoming fieldwork.

DRAWN BY	CHECKED BY	DOCUMENT MANAGER	PROJECT MANAGER
BB 10/15/92	[illegible] 10/15/92	[illegible] 10/15/92	[illegible] [illegible]

REV. DATE 10/15/92



EXPLANATION

● EE2	WELL NUMBER AND APPROXIMATE LOCATION
○ B-3	PROPOSED SOIL BORING AND NUMBER
▲ LFG-1	PROPOSED LANDFILL GAS PROBE AND NUMBER
⊕ MW-10	PROPOSED MONITORING WELL LOCATION AND NUMBER
	SURFACE SOIL GRID SAMPLING AREA AND SAMPLING POINTS
㉑	AIR SCREENING LOCATION*

* See Table 6 for results of air screening at each station

0 400 800
SCALE IN FEET

N

Burlington Environmental Inc.

AMBIENT AIR SCREENING LOCATIONS
OCTOBER 6, 1992

PASCO LANDFILL
PASCO, WASHINGTON
624419

FIGURE 3

Table 5

AMBIENT AIR SCREENING RESULTS
OCTOBER 6, 1992
PASCO LANDFILL
PASCO, WASHINGTON

Location Number*	HNu (ppm)	LEL (%)	H_2S (ppm)	O_2 (%)
1	0	0	0	21.0
2	0	0	0	21.0
3	0	0	0	21.0
4	0	0	0	20.9
5	0.2	0	0	20.9
6	0	0	0	20.9
7	0.2	0	0	20.9
8	0	0	0	20.9
9	0	0	0	20.9
10	0	-2	0	20.9
11	0	-1	0	20.9
12	0	-1	0	20.9
13	0	-1	0	20.9
14	0	0	0	20.8
15	0	0	0	20.9
16	0	0	0	20.9
17	0	0	0	20.9
18	0.4	0	0	20.9
19	0.5	0	0	20.9
20	0.5	0	0	20.9
21	0	0	0	20.9
22	0	0	0	20.8

*See Figure 3 for air screening locations

During the initial site walkover, 12 of the 19 existing wells were observed to be actively venting, apparently due to a drop in barometric pressure. Wellhead air quality measurements were taken at each well using the same instruments used for the ambient air screening. Readings were taken immediately after opening each well. The results, as summarized in Table 6, show levels of detectable volatile organics elevated above ambient air concentrations at all wells. LEL levels are also of concern at three wells (Wells 3, 4 and 7). During this screening event, H_2S was not detected.

3.5.2 Area (Safety) Monitoring

Prior to initiating any activities at the existing or new wells and landfill gas probes, screening with the CGI in the immediate vicinity of the well or probe, including the wellhead, will be completed. Should explosive levels reach 10% LEL, the crew will retreat from the well. A positive air flow system will be located upwind of the well or probe in an area of 0% LEL. The crew will then approach the well or probe from the upwind side and repeat the CGI screening. If the LEL is below 10%, the measurement or sampling activities can continue. If not, the well cap shall be replaced, and the crew will retreat from the area and seek assistance.

Monitoring shall also be conducted during drilling and sampling activities for organic vapors to ensure that the survey personnel are properly protected. Air quality measurements (PID) will be taken approximately on a continuous basis (as practically possible) when drilling. Air space around the open boreholes will be monitored and the Site Safety Officer will determine if additional monitoring with a combustible gas indicator (CGI) or a hydrogen sulfide (H_2S) monitor is necessary or a higher level of personal safety is needed. If a CGI is used, the alarm and action level for halt/work area evacuation is 10% of the lower explosive limit for hexane, pentane, or methane.

Table 6

WELLHEAD SCREENING SUMMARY

PASCO LANDFILL
PASCO, WASHINGTON

Well No.	Completion Type[1]	HNU (ppm)[2]	LEL (%)[3]	H_2S (ppm)[3]	O_2 (%)[3]	Comments
1	R	2.9	0	0	20.6	
2	SS	8	NA	NA	NA	
3	R	155	6	0	12.0	No riser cap; gas venting
4	SS	6	400	0	7.1	Gas venting
5	SS	4	0	0	20.4	Gas venting
6	SS	3.5	0	0	14.0	Gas venting
7	SS	1,200	385	0	14.0	Gas venting; sour odor around well
8	SS	3	3	0	19.6	Gas venting
9	SS	3	0	0	19.9	Gas venting
EE-1	SS	3.5	0	0	20.8	
EE-2	SS	9.5	3	0	19.0	Gas venting
EE-3	SS	13.5	0	0	18.0	Gas venting
EE-4	R	3	0	0	20.8	
EE-5	SS	3	-1	0	20.8	
EE-6	SS	2.5	2	0	19.7	Gas venting
EE-7	SS	5	0	0	20.8	
EE-8	SS	4	0	0	20.1	
EE-9	R	5	1	0	18.0	Gas venting
CONTROL	SS	3	0	0	20.0	Gas venting

[1]R - Riser with cap
SS - Sampling system

[2]Probe tip inserted into open riser

[3]Meter intake port held over open riser

bPasco:HSP.6

Note: As discussed above, monitoring for combustible gases and hydrogen sulfide will be required initially during drilling due to initial wellhead screening results (see Section 3.5.1). Because of the on-site disposal of quantities of flammable organic solvents, the CGI must be calibrated to hexane or pentane until soil-gas (or other) confirmed laboratory analysis demonstrates that the predominant flammable vapor hazard is methane, not organic solvents with much lower explosive limit concentrations. If methane is the principle hazard, thereafter, calibrate with methane (natural gas).

The decision for additional monitoring will be based upon field conditions such as change in organic concentrations from a borehole, breakthrough in cartridge respirators, complaints of initial acute exposure symptoms from field personnel, or other indications of a potential hazard. Detection of the "rotten egg" odor is a warning property of hydrogen sulfide (H_2S) and will require H_2S monitoring or Level B protection to continue that operation. Specific monitoring instruments and decision levels are summarized in Table 4.

3.5.3 Personnel Air Sampling

Personnel air sampling may be conducted to assess the airborne concentration of identified contaminants and verify appropriate selection of respiratory protection equipment. The decision to conduct personnel air sampling will be made by the Site Safety Officer in consultation with the Health and Safety Department, and will be based on area monitoring results, site characterization findings, or the need for additional information.

3.6 Site Control

The Site Safety Officer will establish decontamination zones and control zones within the study area to ensure that personnel are properly protected against hazards and that contamination is confined to appropriate areas. A map of the site showing existing and proposed sampling

locations is shown on Figure 3. The work zones may vary and may require modification depending on the field activities, field findings, and prevailing wind direction. All activities within the contaminated area shall be conducted with a partner using the buddy system or radio contact with ten-minute radio checks.

3.7 Safe Work Practices

The Site Safety Officer will require and enforce safe work practices on the job site. Any on-site project person who is not abiding by correct, safe procedures will be reminded immediately of the proper way to perform the assigned task. **ANY PERSON REFUSING TO COMPLY WITH CORRECT PROCEDURES WILL BE REQUIRED TO STOP WORK AND WILL BE REMOVED FROM THE FIELD OPERATION.**

In general, project safe work practices will include using equipment and chemical supplies according to manufacturer's instructions, and applying Standard Safety Operating Procedures developed for field operations. Safety Operating Procedures (SOPs) specifically required for this project and provided for reference in this document include:

SOP NUMBER	TITLE	Appendix
442	Use, Calibration, and Maintenance of Photoionization Detectors	B
214	Documentation of Site Training	C
325	General Safety Rules for Drill Rig Operations	D
445	Use, Calibration, and Maintenance of Combustible Gas Indicators and the Manufacturer's Instructions on Maintenance and Calibration of the Hydrogen Sulfide Monitor	E
505	General Safety Rules For Work On Hazardous Waste Sites	F
508	General Safety Rules for Environmental Sampling with the RECON℠ Multimedia Sampling System	G

3.8 Decontamination

3.8.1 Personnel

Prior to commencing fieldwork, the Site Safety Officer will establish the decontamination layout and procedures for the site. All personnel leaving zones designated by the Site Safety Officer as potentially contaminated must follow the decontamination procedures established by the Site Safety Officer. Most of the protective clothing for modified Level D and Level C protection is disposable and should be removed, bagged, and properly disposed of. If nondisposable clothing is used, it must be decontaminated with detergent and water before reuse. If respirators are worn, they must be disinfected daily using the manufacturer-supplied disinfectant solution. All personnel should shower as soon as possible after leaving the site. Specific procedures for modified Level D and Level C are shown in Table 5.

Equipment for decontamination measures will include 20- to 30-gallon wash basins, plastic liners, plastic drop cloths, Alconox, rinse water, scrub brushes, towels, benches or stools, tape, and face masks and cartridges.

3.8.2 Equipment

The sampling equipment will be decontaminated with a steam cleaner and Alconox and water between sampling stations.

Table 7

DECONTAMINATION PROCEDURES

PASCO LANDFILL
PASCO, WASHINGTON

Modified Level D and Level C Decontamination:

Segregated equipment drop	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboard, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop site reduces the probability of cross-contamination. During hot weather operations, a cool-down station may be set up within this area.
Tape removal	Remove tape around boots and gloves and deposit in container with plastic liner.[a]
Outer glove removal	Remove outer gloves and deposit in container with plastic liner.
Boot wash	Wash safety boots with long-handled scrub brush and alconox detergent. Rinse off decontamination solution with water. Repeat as many times as necessary.
Canister or mask change[b]	If worker leaves exclusion zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and joints taped, and worker returns to duty.
Safety boot removal	Remove safety boots and deposit in container with plastic liner.
Facepiece removal[a]	Remove facepiece. Deposit in container with plastic liner. Avoid touching face with fingers.
Inner glove removal	Remove inner gloves and deposit in lined container.

Table 7 (continued)

DECONTAMINATION PROCEDURES

PASCO LANDFILL
PASCO, WASHINGTON

Inner clothing removal	Remove clothing soaked with perspiration and place in lined container. If inner clothing is contaminated, do not wear off-site. If inner clothing is not contaminated, inner clothing may be worn off-site.
Field wash	Shower if highly toxic, skin-corrosive, or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.
Re-dress	Put on clean clothes.

---

[a] Burlington will be responsible for disposition of all waste material including disposable clothing.
[b] Additional requirements for Level C decontamination.

4 TRAINING AND MEDICAL MONITORING REQUIREMENTS

Personnel training and medical monitoring requirements of this Phase I RI are outlined in this section.

4.1 Training Requirements

All Burlington employees will be trained to recognize and avoid the potential hazards at the job site. All field personnel and the Project Manager have received 40 hours of training covering the following:

- site safety plans;
- safe work practices;
- nature of anticipated hazards;
- handling emergencies and self-rescue;
- rules and regulations for vehicle use;
- safe use of field equipment;
- handling, storage, and transportation of hazardous materials;
- employee rights and responsibilities;
- use, care, and limitations of personal protective clothing and equipment; and
- safe sampling techniques.

In addition, all Burlington employees will be properly trained in the use of an air-purifying respirator and in its capabilities, limitations, and maintenance. As required under Occupational Safety and Health Administration standards, all personnel must be qualitatively fit-tested prior

to wearing a respirator. The Burlington Site Safety Officer will be trained in the proper selection of respiratory protection, protective clothing, fit-testing procedures, air monitoring instruments and techniques, confined space entry, hazard recognition and evaluation, and exposure symptoms for the contaminants of concern.

In addition to basic safety training for work on hazardous waste sites, all project field personnel must attend a site-specific health and safety orientation and daily refresher health and safety meeting to discuss specific site operations and applicable safety procedures for that day. Project safety meetings shall be presented by the Site Safety Officer and must be documented. The site health and safety meetings must include presentation and discussion of applicable portions of the Pasco Landfill Safety Plan (Appendix A).

4.2 Medical Monitoring Requirements

In accordance with the Burlington Corporate Health and Safety Program, all employees who may be exposed to hazardous materials in the course of their work are required to participate in the Corporate Medical Monitoring Program. Prior to working at the site, all employees must receive a baseline medical examination, including analysis of blood and urine for heavy metals. All employees must also be certified as fit for working with a respirator. If an employee suspects exposure, additional medical monitoring will be available and the employee must submit an Exposure/Injury Incident Report. All employees participating in this project will be required to undergo annual follow-up medical examinations.

5 EMERGENCY PLANNING

It will be the responsibility of the Burlington Site Safety Officer to determine the appropriate response to an emergency incident. The response sequence will be to 1) remove all personnel from the area, 2) assess the severity of the incident, 3) contact appropriate emergency assistance, and 4) swiftly move to a rendezvous point for aid. The following planning measures will be instituted to facilitate responses to emergency situations:

1. The Site Safety Officer will conduct a safety briefing prior to the start of work. Copies of this Health and Safety Plan will be distributed to all project personnel. After reading the plan, all personnel will be required to sign a Health and Safety Plan consent agreement. The consent agreement form is included as Appendix C.

2. All Burlington personnel will review the client/worksite facility safety procedures.

3. All Burlington personnel will be instructed in the use of all field safety equipment before any field sampling takes place.

4. The Project Manager will verify that all field staff have fulfilled the project training and medical monitoring requirements.

5. The Site Safety Officer will notify the Client/Worksite facility Manager of the field activities and potential chemical exposures prior to commencement of the field effort.

6. The Site Safety Officer will check to see that all required safety equipment is at the job site prior to the start of each day's field activities.

5.1 Emergency Communications Protocol

The following visual signals will be used as emergency communication signals:

- Hand clutching throat: out of air/can't breathe;
- Hands on top of head: needs assistance;
- Thumbs up: OK/I'm alright/I understand;
- Thumbs down: no/negative; and
- Grip partner's wrist or both hands around partner's waist: leave area immediately.

Radios will be used when the Site Safety Officer is not present or more than two tasks are performed simultaneously.

5.2 Injury or Exposure

Employees are required to notify the Site Safety Officer of any suspected exposure. In the event of any injury or suspected exposure, the Site Safety Officer will contact the appropriate hospital and ambulance service if necessary, through the 911 emergency number. The emergency route from the site is described in Section 6.

After the accident site has been secured and the emergency situation has passed, the Site Safety Officer must immediately report the incident by telephone to his Department Manager and to the Corporate Health and Safety Officer. Before the end of the day's working shift, an accident report form must be completed and received by the Corporate Health and Safety Department within 24 hours. This report will detail the circumstances of the accident.

6 EMERGENCY CONTACTS

Note: All emergency contact numbers and hospital route to be verified prior to start of on-site operations.

Hospitals

Our Lady of Lourdes Health Center
4th Street and Sylvester
(509) 546-2201
Pasco, Washington

Direction from Pasco Landfill to Nearest Hospital (Lady of Lourdes)

Leaving main entrance/exit outside the weigh station at the Pasco Landfill, head south parallel to Highway 12. At the end of the road, cross over the highway and take a right. Head west on Lewis Street. Continue on Lewis Street, driving underneath the railroad tracks through a short tunnel until arriving at the intersection of 4th Street. Take a right on 4th Street and drive north four blocks through the intersection of 4th Street and Sylvester. Take the first left (east) and drive to the entrance of Our Lady of Lourdes Health Center (see Figure 3).

Emergency Medical Information

Poison Information Center	(800) 572-9176	Yakima, Washington

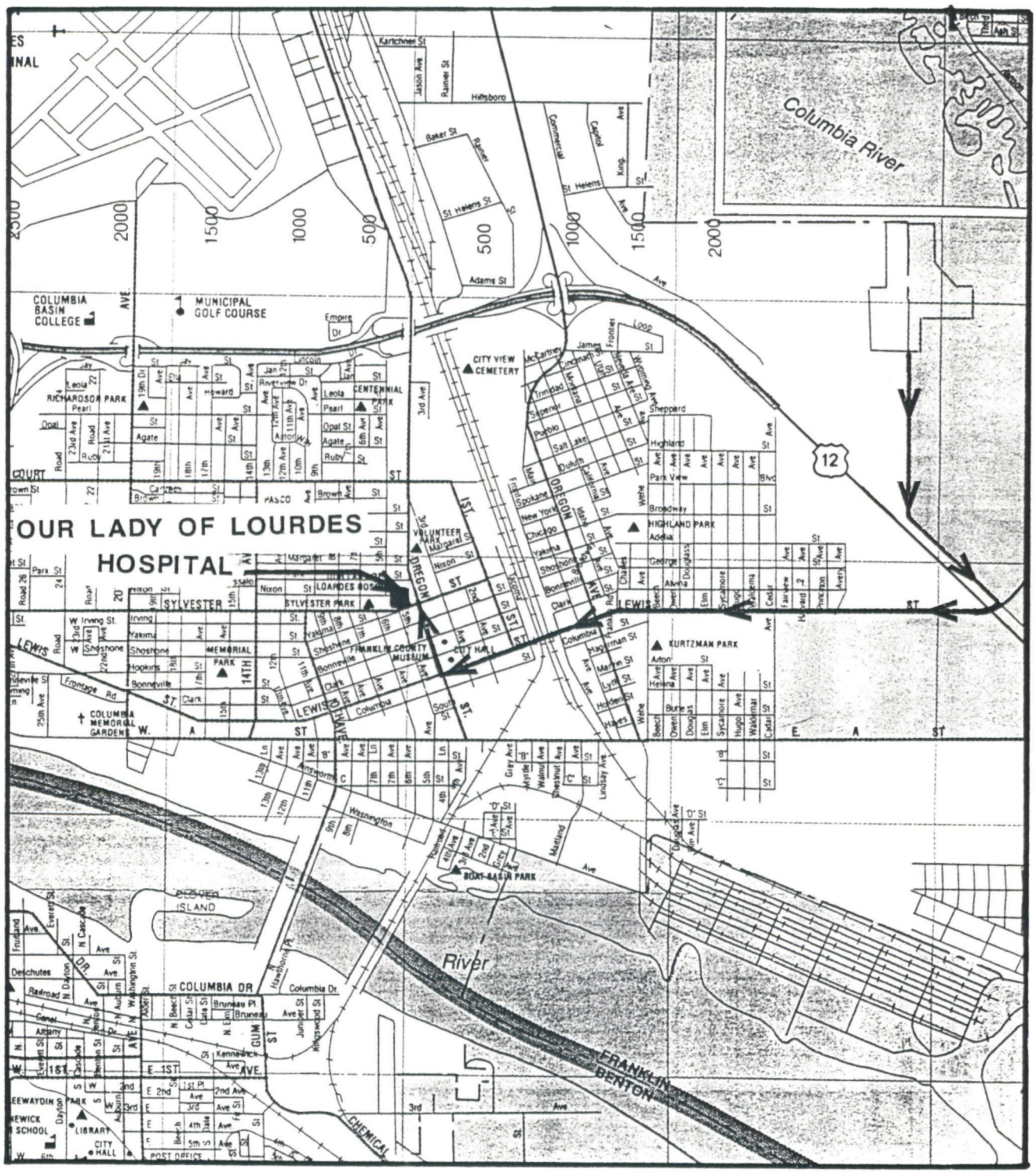
Emergency Transportation Systems (Police, Fire, Ambulance)

Police Department	911
Fire Department	911
Ambulance Service	911

Corporate Resources

Project Manager David Haddock	Work (206) 767-3306 Home (206) 562-0116 Beeper (206) 989-6941	Site Supervisor Craig Maxeiner	Work (206) 767-3306 Home (618) 281-6334
Health and Safety Officer Frank Gardner	Work (206) 223-0500 Home (206) 493-0832	Site Safety Officer Craig Maxeiner	Work (206) 767-3306 Home (618) 281-6334

DRAWN BY	CHECKED BY	DOCUMENT MANAGER	PROJECT MANAGER
BB 10/15/92			



DIRECTIONS:

GO SOUTH ON ACCESS ROAD PARALLEL TO HIGHWAY 12. CROSS OVER HIGHWAY AND TURN RIGHT ON LEWIS STREET. CONTINUE ON LEWIS STREET TO 4TH STREET. MAKE A RIGHT ON 4TH STREET. PROCEED FOUR BLOCKS THROUGH INTERSECTION OF 4TH AND SYLVESTER. HOSPITAL ENTRANCE IS THE FIRST LEFT PAST THE INTERSECTION.

OUR LADY OF LOURDES HOSPITAL: 509-546-2201

Burlington Environmental Inc.

EMERGENCY ROUTE MAP

PASCO LANDFILL
PASCO, WASHINGTON
624419

FIGURE 4

APPENDIX
A

APPENDIX A

Pasco Landfill Safety Plan

SECTION 4 - SAFETY PLAN

1. Purpose: The purpose of this safety plan is to provide limited instructions for the operations personnel at the Pasco Sanitary Landfill. These actions include immediate individual actions to be taken to remedy the situation or notification-type actions.

2. Actions to Take In-Case of Fire at the Fill (Non-Chemical)

   (a) Pick up or spread the burning material with the dozer or compactor and spread this material to a non-flammable area.

   (b) Cover the material with dirt and if necessary follow with a water application.

   (c) Notify permitting agency and local fire officials.

3. Actions to Take In-Case of Fire at the Fill (Chemical Origin)

   (a) Pick up or spread the burning material with the dozer or compactor and spread this material to a non-flammable area.

   (b) Cover the material with dirt.

   (c) Do not add water to a fire which appears to be of a chemical origin.

   (d) Avoid inhaling fumes, smoke or vapors even if no hazardous material appear to be involved.

   (e) Do not assume that harmless gases or vapors are involved because of a lack of smell.

   (f) Notify local firefighting agencies and permitting agency.

   (g) Provide directions to outside support organizations upon arrival (as needed).

   (h) Keep all personnel up-wind and clear of the incident.

4. Actions to Take If Questionable Materials Arrive at the Gate

   (a) Hold the truck or shipment vehicle.

   (b) Contact the generator to determine if the material is an acceptable waste.

   (c) If the question of acceptability can't be answered, contact the Benton-Franklin Health Department, Mr. Larry Kamberg, (509)943-2614, to resolve this issue. If a decision can't be reached in an acceptable amount of time the truck carrying the waste can unhook its trailer, to be left for later disposition, or the material can be sent back to the generator.

5. Actions to Take if Leaks are Detected

(a) Fuel Storage Tank

(1) If a leak is detected in the fuel storage tank contact a commercial fuel hauler and have the tank's contents pumped into a tanker.
(2) Repair or replace fuel storage tank.
(3) Conduct appropriate tests to determine degree of contamination.

6. Actions to Take if Groundwater is Contaminated:

An extensive groundwater monitoring program is being carried out at the landfill and if groundwater was to be become contaminated the appropriate regulatory agencies would be notified through normal communications relative to this monitoring effort. Decisions regarding corrective action would be made jointly after consideration by all the parties involved.

7. Emergency Responses:

In the event that medical assistance, fire department assistance or police assistance is required on an emergency basis, the landfill operator is to call 911 and report the incident immediately. In the event that any type of emergency occurs when the landfill owner is not present, he is to be contacted immediately at (509)545-8155. The 911 number is also good for obtaining help in response to a chemical spill.

APPENDIX
B

APPENDIX B

Health and Safety Operating Procedures #442

Use, Calibration, and Maintenance of
Photoionization Detectors

PURPOSE

This procedure describes the preferred method for use, calibration and maintenance of Photoionization detectors to be followed by Mathes personnel using this instrument.

REFERENCES

Instruction Manual Trace Gas Analyzer HNU Model PI 101

Users Manual Photovac Tip II

Mathes H&S Procedure 441 - Air Quality Monitoring Instrumentation, General Use, Calibration, and Maintenance.

Instrument Specific Logbook

EQUIPMENT

Equipment Case and Contents
HNU PI-101
PHOTOVAC - Tip II

FORMS

None.

RESPONSIBILITIES

The Site Supervisor, Department Manager, Health and Safety Department, and the Instrument User have the following responsibilities, supplemental to those specified in Mathes H&S Procedure 441, to implement this procedure.

Site Supervisor:

1. Maintain the instrument as required.

2. Use an operational instrument on the job site.

3. The duty to use and maintain the instrument may be delegated to a Site Safety Officer, if available.

Department Manager:

1. Submit the instrument at least every six months for a full calibration by a qualified technician or the manufacturer.

2. Assign only qualified technicians to operate the instrument.

H&S Department:

1. Review instrument use on field projects to determine appropriate action levels.

2. Audit selected field projects to determine the manner in which the instrument is used.

3. Provide training, upon request, for field technicians.

4. Inspect instruments as judged appropriate or necessary.

Instrument User:

1. Use the instrument in accordance with H&S Department manufacturers recommendation.

2. Attend a training class on the proper use, limitations, calibration and maintenance of the instrument.

3. Use, calibrate and maintain the instrument in accordance with this procedure and H&S Procedure 441.

4. Follow the site-specific instrument use specifications and protocols provided by the H&S Department.

5. If an instrument malfunction is detected, promptly report the problem to your Department Manager or, if in the field, your Site Supervisor.

DISCUSSION

The Photoionization detector is one of the most extensively used instruments on hazardous waste sites. It is imperative that the instrument be used, calibrated and maintained in the proper manner. The following procedure should be closely followed by those individuals using, calibrating, and maintaining Photoionization detectors in the field in order to ensure that the instrument functions correctly. Also, persons using the instrument should have been trained and have read the Instruction Manual prior to using the instrument.

APPENDICES

Appendix A - Operating Instructions for the HNU PI-101
Appendix B - HNU Detector Cleaning Procedure
Appendix C - HNU Troubleshooting and Minor Repair Procedure
Appendix D - Operating Instructions for the Photovac Tip II
Appendix E - TIP Detector Cleaning Procedure
Appendix F - TIP Troubleshooting and Minor Repair Procedure

PROCEDURE

Perform the items listed below.

1. Equipment Checkout - (Done prior to removing the PID from the equipment room).

   1.1 Inspect the PID equipment case to see if the necessary equipment is available. The equipment which is to accompany the instrument is specified in section one of the Appendix for the respective instrument (Appendix A or D).

   1.2 Perform the assembly and functional checks outlined in Section 2.0 of the Appendix for the respective instrument (Appendix A or D).

2. Calibration - (to be done prior to using the instrument).

   2.1 This instrument must be calibrated daily. Perform the calibration described in Section 3 of the appendix describing the instrument being used (Appendix A or D).

3. Operation - Operate the instrument only after all of the above steps have been taken.

   3.1 Operate the instrument in accordance with the instructions given in Section 5 of the Appendix (Appendix A or D) describing the instrument being used.

4. Maintenance

   4.1 Instruments must be maintained in a clean and undamaged condition. Wipe any dirt or debris from the instrument after use, and perform or obtain repairs, when needed.

4.2 All other maintenance shall be performed in accordance with the specific instructions which can be found in the manufacturers instruction manual.

5. Rental Equipment

5.1 Refer to the instruction manual of the specific instrument used to determine the calibration, use, and maintenance procedures to be followed.

EXCEPTIONS None.

END OF H&S PROCEDURE 442

APPENDIX A
OPERATING INSTRUCTIONS FOR THE HNU PI-101

Perform the items listed below.

1. Equipment Checkout - (Done prior to removing the HNU from the equipment room).

   1.1 Inspect the HNU Equipment Case to see if the necessary equipment is available. The case should include the following:

   - o One readout assembly
   - o One probe assembly
   - o One probe extension
   - o One calibration cylinder (HNU Part Number 101-350)
   - o One cylinder regulator (HNU part number 101-351) with tubing
   - o One instrument log book
   - o One hair dryer
   - o Cleaning supplies:
     - HNU Light Source Cleaning Compound,
     - Ethyl Alcohol (for 10.2 eV lamp),
     - 1,1,1 Trichloroethane (for 11.7 eV lamp), and
     - Cotton balls, cotton swabs and pipe cleaners
   - o Regular Screwdriver
   - o Phillips Screwdriver
   - o 9 Volt Battery (rectangular)
   - o Latex Surgical Gloves

2. Assembly and Functional Check

   2.1 Prior to taking the instrument from the storage area, check the batteries to see if they are adequately charged.

   2.2 Connect probe assembly to readout assembly and screw the probe extension onto the end of the probe.

   2.3 Turn the function switch to the "BATT" (battery check position.

   2.4 If the batteries are properly charged the needle will fall within the upper end of the green area on the meter scale. Otherwise, the instrument needs to be connected to the battery charger.

   2.5 Turn the function switch on the instrument to standby.

   NOTE: The high voltage interlock (small red button) switch must be fully depressed to check or operate the instrument.

APPENDIX A, Continued
OPERATING INSTRUCTIONS FOR THE HNU PI-101

3. Field Calibration

3.1 Attach the regulator to the cylinder of calibration gas.

3.2 Check the cylinder pressure reading on the regulator. The cylinder must have a pressure of at least 30 psi to be used for a calibration check.

3.3 Turn the instrument's function switch to the 0-200 range.

3.4 Fit the loose end of the tygon tubing attached to the regulator over the end of the probe extension.

3.5 Open the regulator valve and check to see if the reading on the instrument corresponds to the ideal response listed on the calibration gas cylinder. The response should occur in about 12 seconds.

3.6 If the HNU reading does not correspond to the ideal response, adjust the span setting and perform subsequent checks until the HNU readings do correspond. Cleaning may be necessary if span setting adjustments do not achieve the ideal response reading. See Attachment 1.

NOTE: When the span setting is decreased the meter response on the HNU should increase. When the span setting is increased the meter readings should decrease.

3.7 Record the following data in the dedicated logbook for the instrument.

- o Date and Time of Calibration
- o Calibration Gas Used
- o Ideal Response Reading Printed on the Calibration Gas Cylinder
- o Lot Number of Calibration Gas
- o Three successive readings (within one NDU of the ideal response)
- o Final Span Setting after Calibration
- o Signature

4. Bi-annual Calibration

4.1 A calibration performed every six months is not required. This instrument is calibrated daily.

APPENDIX A, Continued
OPERATING INSTRUCTIONS FOR THE HNU PI-101

5. Routine Use

5.1 Connect the probe assembly to the readout assembly.

NOTE: Make sure that cable connector "snaps" into place so that interlock switch is properly depressed. If this is not done the instrument will not work.

5.2 Attach the probe extension to the end of the probe. (The probe may be used without the extension if desired).

5.3 Check the battery by turning the function switch to the position labeled, "BATT". If the needle on the meter is in the upper portion of the green area the battery is sufficiently charged. Otherwise the instrument should not be used as it will give erroneous readings.

5.4 Turn the function switch to standby.

5.5 Allow the instrument to warm up for two to three minutes.

5.6 Recheck the calibration of the instrument at least once daily by following the procedure described in Section 2 of this procedure.

5.7 Turn the function switch to the 0-20 range. If the needle on the meter falls below zero, re-adjust the zero knob until the instrument reads zero. Set function switch to desired meter range if other than 0-20.

NOTE: Do not re-adjust the zero on the 0-200 or 0-2000 range settings.

5.8 Record instrument readings as desired, taking into consideration the following limitations.

- o The HNU is very sensitive to moisture. The probe tip should be kept away from water and should not come into direct contact with chemicals.
- o Water vapor (i.e. humidity above 90%, fog, dew, rain, etc.) strongly affects instrument accuracy by lowering response readings.
- o Any foreign materials which accumulate on the lamp will adversely effect instrument readings.

APPENDIX A, Continued
OPERATING INSTRUCTIONS FOR THE HNU PI-101

- o The instrument is adversely influenced by temperatures below 14 degrees or above 104 degrees F.

- o Readings that are apparently low, erratic, unstable, non-repeatable, or drifting may indicate erroneous readings and should prompt a calibration check and, possibly, further maintenance on the instrument.

5.8 Turn the function switch to the standby position when not taking readings with the instrument. This conserves the battery life.

- o Check the battery periodically during use. If the low battery indicator light comes on, turn the analyzer off and recharge.

- o Recharge battery after each field day of instrument use.

5.9 Turn the unit off when done taking readings and replace all equipment in the field case dedicated to the instrument.

5.10 Transport and store instrument and its support equipment in the field case.

5.11 Report faulty, damaged or inoperable instruments as soon as practical to your Manager.

6. Maintenance

6.1 Maintenance is to be performed when meter readings are apparently low, erratic, unstable, non-repeatable or drifting.

6.2 Maintenance should also be performed when several consecutive calibration checks require lowering of the span setting to achieve the ideal response reading.

6.3 At a minimum, instruments must be maintained once every 40 hours of operation. The Department (or on-site) Manager shall review the frequency of use and determine when the instrument requires maintenance.

6.4 The lamp should be cleaned before field calibrations and must be cleaned before a full calibration. A cleaning procedure is provided in Appendix B. Do not clean after calibrating as instrument response will change.

NOTE: 1,1,1-Trichlorethane or freon should be the ONLY solvents used to clean the 11.7eV lamp.

APPENDIX A, Continued
OPERATING INSTRUCTIONS FOR THE HNU PI-101

7. Troubleshooting Problems

7.1 Visually inspect the instrument for obvious problems or conditions (i.e. loose cable connections, cracked cable, excessive dirtiness, damage, etc.) that could cause the instrument malfunction.

7.2 A troubleshooting and minor repairs procedure is provided in Appendix C.

APPENDIX B
HNU Detector Cleaning Procedure

NOTE: Turn the instrument to the OFF position before any disassembly. Otherwise, high voltage of 1,200 volts DC will be present and could cause electric shock.

1. Clean the exterior of the instrument being careful not to let water into the electronics of the probe or readout unit.

2. Remove the probe extension from the probe assembly.

3. Disassemble the probe and remove the lamp and ion chamber.
   - o Disconnect the probe cable connector at the readout assembly.
   - o Remove the exhaust screw at the base of the probe adjacent to the handle.
   - o Grasp the end cap in one hand and the probe shell in the other.
   - o Gently separate the end cap and the lamp housing from the shell.
   - o Hold the lamp housing with the black end cap upright and loosen the screws on the top of the end cap.
   - o Carefully separate the ion chamber in the end cap from the light source. Make sure that neither the light source nor the ion chamber fall.
   - o Carefully remove the lamp from the lamp assembly and the ion chamber from the end cap and place both on a clean, dry surface.

4. Don latex surgical gloves to ensure that your hands do not come in contact with the lamp window.

5. Hold the lamp up and inspect the lamp window for soiling deposits (i.e. dust, films, or discoloration) by viewing the lamp window at an incident angle.

6. If the lamp window is fouled, clean the window as follows: (Take care to prevent foreign materials from touching the lamp window, as that would influence subsequent readings.)
   - o For 9.5 or 10.2 eV lamps, dab a drop of HNU light source cleaning compound on a cotton swab and clean the window by rubbing the swab on the window. For an 11.7 eV lamp, use 1,1,1-trichloroethane or freon.

     NOTE: Do not clean an 11.7 eV lamp with HNU light source cleaning compound.

   - o Wipe off excess cleaning compound with a clean cotton swab or cotton ball.

   - o Rinse the lamp window (of 9.5 eV or 10.2 eV lamps) with a cotton swab dipped in methanol or ethanol. Do not rinse an 11.7 eV lamp.

     NOTE: NEVER USE WATER to rinse the lamp window.

APPENDIX B, Continued
HNU Detector Cleaning Procedure

- Dry with a clean cotton swab or ball.

7. Replace lamp in the lamp housing.

8. Inspect the ion chamber for particulate deposits. Review recent instrument usage log entries and instrument response for indications of moisture fouling.

9. If such deposits are present, the ionization chamber should be cleaned as follows:
   - Remove outer Teflon ring.
   - Remove the four screws holding the retaining ring.
   - Carefully rotate the retaining ring aside and remove the screen. (Note: This ring is soldered and cannot be totally removed without breaking the ionization chamber.)
   - To clean the ion chamber and screen, use a cotton swab wetted with the same solvent as used to clean the lamp. DO NOT use HNU light source cleaning compound to clean the ion chamber.
   - Particulates or moisture shall not be present in the ion chamber upon reassembly, as this would affect the performance of the instrument. Moisture can be anticipated if the instrument was used in a high humidity (or rain) environment prior to cleaning.
   - If moisture is suspected, either bake the chamber in an oven at 120°F to 140°F for 1/2 hour or dry carefully with a hair dryer.
   - Re-assemble the ion chamber and replace it in the end cap.

10. Re-assemble the instrument by reversing the sequence for disassembly.

11. Record the following maintenance information into the instrument logbook.
    - Date and time
    - Description of problem (if other than symptoms of instrument dirtiness or moisture fouling)
    - Maintenance performed
    - Signature

12. Check the operation of the instrument by performing a calibration check as outlined in Section 2.

13. If the instrument is not functioning properly, check to make sure that you have performed this procedure correctly and make sure that the probe assembly has been properly re-assembled.

14. In the event that the cause of instrument malfunction cannot be determined in the field, notify your Department Manager as specified in H&S Procedure 441.

APPENDIX C
HNU TROUBLESHOOTING AND MINOR REPAIRS PROCEDURE

NOTE: Turn the instrument OFF before any disassembly, as electric shock may result.

1. Use Table 1 to determine the probable cause of instrument failure, as well as possible corrective action measures.

TABLE 1

TROUBLESHOOTING INDEX

Symptom	Probable Cause	Corrective Action
1. Instrument shows no sign of power (i.e., meter does not respond, fan not running, etc.) or instrument meter indicates low battery	a. Blown fuse	a. Perform items in Section 2.
	b. Battery is low	b. Recharge battery.
2. Fan not running	a. Low battery	a. Recharge battery.
	b. Fan is stuck	b. Perform items in Section 3.
3. Meter erratic, unstable, or non-repeatable	a. Loose cable connections	a. Check cable connections at meter assembly. Tighten if necessary.
	b. Contamination in ion chamber	b. Perform routine maintenance, including cleaning of ion chamber and lamp.

APPENDIX C, Continued
HNU TROUBLESHOOTING AND MINOR REPAIRS PROCEDURE

2. Blown Fuse

- o Check the fuse as follows:
- o Turn the screw on the bottom of the readout assembly 1/4 turn counter- clockwise.
- o Carefully remove the housing on the readout assembly.
- o Inspect the fuse for charring or a broken or burnt filament. The fuse is located near the circuit panel on the bottom of the readout assembly.
- o If the fuse is charred or has a broken or burnt filament, replace the fuse with a two-amp fuse.

(NOTE: A new two-amp fuse should be taped on the inside of the readout assembly housing.)

- o Replace the readout assembly in the housing.

3. Stuck Fan Blade

To free the fan blade, perform the following steps:

- o Disassemble the probe as described in cleaning procedure, Attachment 1.
- o Locate the red and black wires which lead to the copper cylinder. (Note: This cylinder contains the fan motor and blade. The red and black wires go to the fan motor.)
- o Place the positive terminal of a 9 volt battery on the pogo pin contact which is connected to the black wire.
- o To turn on the fan, touch the negative terminal on the 9 volt battery to the pogo pin contact connected to the red wire. This should dislodge any debris that may have lodged between the fan and the fan housing.

  NOTE: The fan should not be allowed to run for more than one or two seconds, as a longer period of operation could damage the motor.

- o Reverse the polarity on the battery and briefly run the fan again. This should blow dislodged debris clear of the fan.
- o If the fan does not come unstuck, repeat this procedure again.
- o If after several attempts the fan does still not function properly, notify your department manager.
- o Re-assemble the probe assembly.

APPENDIX C, Continued
HNU TROUBLESHOOTING AND MINOR REPAIRS PROCEDURE

4. If trouble cannot be corrected, tag-out instrument and remove from service. Notify your Department Manager and do not use the instrument until the problem is resolved.

5. Record the following information in the instrument log book.

   - o Date
   - o Symptoms of problem
   - o Corrective measures taken
   - o Whether instrument was repaired in field or had to be taken out of service for repairs
   - o Signature

APPENDIX D
INSTRUMENT SPECIFIC INSTRUCTIONS FOR THE PHOTOVAC TIP II

1. Equipment

The following equipment should be included in the equipment case:

- one readout assembly;
- one probe extension;
- one calibration cylinder;
- one cylinder regulator with tubing;
- one instrument log book;
- 1- 3 liter Tedlar bag;
- one hair dryer;
- cleaning supplies:
  - HNU Light Source Cleaning Compound
  - Ethyl Alcohol (for 10.6 eV lamp),
  - 1,1,1 Trichloroethane (for 11.7 eV lamp), and
  - cotton balls, cotton swabs and pipe cleaners;
- regular screwdriver;
- phillips screwdriver;
- 9 volt battery (rectangular); and
- latex surgical gloves.

2. Assembly and Functional Check

Prior to taking the instrument from the storage area, confirm that the batteries are charged and the instrument is functional.

2.1 Press POWER switch to turn on TIP II.

2.2 Unlock ZERO and SPAN controls by turning locking rings clockwise.

2.3 Set SPAN control to 5. Higher or lower SPAN settings may be suitable.

2.4 Lock SPAN control by turning locking ring counterclockwise.

2.5 Allow TIP II to sample clean air.

2.6 Adjust ZERO control until liquid crystal display reads zero.

2.7 Lock ZERO control by turning locking ring counterclockwise - confirm that LCD still displays zero.

2.8 The instrument is ready for field calibration.

APPENDIX D, Continued
INSTRUMENT SPECIFIC INSTRUCTIONS FOR THE
PHOTOVAC TIP II

3. Field Calibration

3.1 Press POWER switch to turn on TIP II. When you press the POWER switch, the LCD of TIP II will turn on and the pump and yellow LEDs will come on briefly. Wait for them to come on continuously, indicating the ultraviolet lamp has started.

3.2 Unlock ZERO and SPAN controls by turning locking rings clockwise. Turn the locking rings down to release the ZERO and SPAN controls.

3.3 Set SPAN control to 5. A mid-range sensitivity (Span setting of 5) is a good place to start.

3.4 Allow TIP II to sample clean air. The cleanliness of your reference Zero air should match your application. Outdoor air away from chemical sources is usually suitable. Although background chemicals will not be cancelled out as they are when TIP II is used qualitatively, the error they cause is usually insignificant. If the zero reference air contains 1 ppm equivalent of total ionizables, the TIP II is adjusted to read 100 when Span Gas is introduced, then in fact TIP II will read, 1 when air with no ionizables is sampled. The error will decrease as concentration increases. If your outdoor air is too heavily contaminated, bottled Zero Air should be used.

3.5 Adjust ZERO control until LCD reads zero (see operation). Turning the ZERO control will raise the LCD reading, turning it counterclockwise will lower it. Adjust the COARSE ZERO control with a small slotted screwdriver if TIP II always reads above or below zero with the ZERO control alone.

3.6 Connect bag to Span Gas to TIP II inlet. Fill the gas bag.

3.7 Adjust SPAN control until LCD indicates the Span Gas concentration (nominally 100 ppm isobutylene). Disconnect gas bag. Hand tighten the gas bag adapter nut to TIP II inlet, and open the gas bag valve.

3.8 Sample clean air again and readjust ZERO control if necessary. A clockwise turn of the SPAN control will raide the LCD reading, a counterclockwise turn will lower it.

APPENDIX D, Continued
INSTRUMENT SPECIFIC INSTRUCTIONS FOR THE
PHOTOVAC TIP II

3.9 Lock ZERO control by turning locking ring counterclockwise. You should check the zero setting by sampling clean air again. Reset the ZERO control, if needed.

3.10 Sample Span Gas again and readjust SPAN control if necessary. Turn the locking ring against the SPAN control.

3.11 Lock SPAN control by turning locking ring counterclockwise. Disconnect gas bag. Check the SPAN setting by sampling Span Gas. Setting ZERO and SPAN controls is an iterative procedure. With experience, your initial settings will be close to your final settings.

3.12 Observe readings on LCD. Concentration of total ionizables is displayed in Span Gas equivalent units. Sample clean air while locking the ZERO control and sample Span Gas while locking the SPAN control, and hold the controls so that they don't shift when their locking rings are turned against them.

3.13 Do not allow TIP II to draw in any liquid. The LCD will now show concentrations of total ionizables in the sample in Span Gas equivalent units. Naturally, part per million readings taken with TIP II only have meaning when there is a single compound present in the sample. A mixture of two or more compounds will give a composite reading which, due to differences in response, will obviously NOT be the simple sum of the concentrations of each component. Nevertheless, there can often be a benefit to such a reading, for example, in studying the distribution of an accidental spill of gasoline.

3.14 Press POWER switch after use to turn off TIP II. Switch off TIP II when you are finished taking readings or if the "LOBAT" sign appears at the top left of the LCD. Readings taken while "LOBAT" is on may not be reliable.

3.15 If the TIP reading does not correspond to the ideal response, adjust the span setting and perform subsequent checks until the TIP readings do correspond. Cleaning may be necessary if span setting adjustments do not achieve the ideal response reading. See Appendix E.

NOTE: When the span setting is decreased the meter response on the TIP should increase. When the span setting is increased the meter readings should decrease.

APPENDIX D, Continued
INSTRUMENT SPECIFIC INSTRUCTIONS FOR THE
PHOTOVAC TIP II

3.16 Record the following data in the dedicated logbook for the instrument:

- o date and time of collection;
- o calibrated gas used;
- o ideal response reading printed on the calibrated gas cylinder;
- o lot number of calibration gas;
- o three successive readings (within one TIP of the ideal response);
- o final span setting after calibration; and
- o signature.

4. Bi-Annual Calibration

A calibration performed every six months is not required. This instrument is calibrated daily.

4.1 Maintenance is to be performed when meter readings are apparently low, erratic, unstable, non-repeatable or drifting.

4.2 Maintenance should also be performed when several consecutive calibration checks require lowering of the span setting to achieve the ideal response reading.

4.3 At a minimum, instruments must be maintained once every 40 hours of operation. The Department (or on-site) Manager shall review the frequency of use and determine when the instrument requires maintenance.

4.4 The lamp should be cleaned before field calibrations and must be cleaned before a full calibration. A cleaning procedure is provided in Appendix E. Do not clean after calibrating as instrument response will change.

NOTE: 1,1,1-Trichlorethane or freon should be the ONLY solvents used to clean the 11.7 eV lamp.

5. Routine Operation

5.1. Press POWER switch to turn on TIP II.

APPENDIX D, Continued
INSTRUMENT SPECIFIC INSTRUCTIONS FOR THE
PHOTOVAC TIP II

Upon pressing the POWER switch, you will see numerals on the liquid crystal display (LCD), the pump wil run for half a second, and the yellow light-emitting diodes (LEDs) in the display compartment will flash on for half a second. Within three minutes, the pump and LEDs will come on continuously indicating that the ultraviolet lamp of TIP II has started.

5.2. Unlock ZERO and SPAN controls by turning locking rings clockwise.

The locking rings on the ZERO and SPAN controls are designed to operate by pressing against the underside of the control knobs. Turn the locking rings clockwise to release the knobs.

5.3 Confirm that the instrument was calibrated within the last 24 hours. If not, perform the field calibration defined in Section 3 of this Attachment.

5.4 Confirm that the span setting selected on the instrument matches the span setting documented in the calibration logbook.

5.5 Allow TIP II to sample clean air.

Clean air is, of course, a relative term. Outdoor air is often a suitable zero reference. Zero TIP II upwind from a spill site or a waste site. For indoor leak detection work, zero TIP II on indoor air away from the suspected leak.

5.6 Turn the ZERO control clockwise to increase the reading or counter-clockwise to decrease it. By adjusting the LCD to read zero, any background chemicals in the air are cancelled out. If the reading fluctuates too much you may have to use a lower span setting. Sampling in a windy location will cause the reading to jump, so keep the inlet sheltered. If the chemical concentration in the air is fluctuating, then so will the output of TIP II.

5.7 Lock ZERO control by turning ring counterclockwise - confirm that LCD still displays zero.

APPENDIX D, Continued
INSTRUMENT SPECIFIC INSTRUCTIONS FOR THE PHOTOVAC TIP II

5.8 Now you are ready to being your investigation. As you move close to chemical sources, the LCD will register higher concentrations, allowing rapid source determination. A negative LCD reading indicates the sample has fewer total ionizables than the zero reference air. With a headset connected to TIP II you can hear concentration changes as frequency changes, and you need not look at the LCD. This is especially useful in extended periods of work, where your eyes may become tired.

5.9 Do not allow TIP II to draw in any fluid.

5.10 Turn TIP II off when you are finished, or when the "LOBAT" sign appears at the top left of the LCD.

APPENDIX D, Continued
INSTRUMENT SPECIFIC INSTRUCTIONS FOR THE
PHOTOVAC TIP II

6. Troubleshooting Problems

6.1 Visually inspect the instrument for obvious problems or conditions (i.e. loose cable connections, cracked cable, excessive dirtiness, damage, etc.) that could cause the instrument malfunction.

6.2 A troubleshooting and minor repairs procedure is provided in Appendix F.

APPENDIX E
TIP DETECTOR CLEANING PROCEDURE

As TIP II is used, a film of deposit will build up on the window of the ultraviolet lamp. The rate of film build-up depends on the chemicals and concentrations being sampled, and results from the action of ultraviolet light on the chemicals. Clean the lamp window when a span setting of 2 is insufficient to give a high enough LCD reading.

1. Switch off TIP II.

2. Grasp the black detector cover and unscrew it from TIP II. The detector cell, lamp holder and lamp UHF driver circuit board are now exposed. Be careful of the PID seal o-ring on top of the detector cell.

3. Unplug red and yellow wires from UHF driver circuit board.

4. Grasp lamp holder so it will not rotate, and unscrew detector cell (with red and yellow wires attached) from lamp holder. Lamp will pop up.

5. Withdraw lamp from lampholder. Leave spring in lamp holder.

6. Moisten a lint-free tissue with methanol.

7. Rub lamp window with methanol-moistened tissue to remove film.

8. Dry lamp window with clean lint-free tissue.

9. Without touching window, slip lamp into lamp holder, window-end out.

10. Install detector cell onto lamp holder and tighten until just snug. Avoid cross threading.

11. Plug yellow wire onto gold pin and red wire onto tinned pin on UHF driver circuit board.

12. Install detector cover hand-tight.

When the detector cell is removed, be careful not to touch the fine wire mesh inside it. Any dirt in the detector cell may be blown out with a gentle jet of dry compressed air.

APPENDIX E, Continued
TIP DETECTOR CLEANING PROCEDURE

TIP II is equipped with a dust filter to reduce detector contamination. As the filter becomes clogged, TIP II inlet flowrate and sensitivity will drop. If TIP II sensitivity increases by more than 10% when the filter is removed then install a new filter. Don't run TIP II without a filter for more than a minute or so.

1. Switch off TIP II.

2. Hold filter housing near detector cap with 9/16-inch wrench.

3. Unscrew top of housing with another 9/16-inch wrench. Be careful of the metal sealing washer.

4. Remove spring and filter.

5. Install new filter open end first.

6. Slip spring into top of housing and assemble housing. Tighten with two wrenches.

Water drawn into TIP II will not cause permanent damage if the instrument is promptly disassembled and cleaned. The most important parts to clean are the lamp and the detector cell. To clean the pump, allow TIP to run until no more water comes out of vent hole located in the front bulkhead.

1. Refer to the procedure, "Cleaning the Lamp Window", to remove the detector cell and lamp.

APPENDIX F
TIP TROUBLESHOOTING AND MINOR REPAIR PROCEDURE

1. Troubleshooting

1.1 Nothing happens when POWER Switch pressed:

- o battery discharged (connect charger. Charge for 16 hours.
- o battery disconnected. Reconnect battery.

1.2 Numerals appear on LCD, but pump and LEDs never stay on continuously. TIP II front bulkhead warms up quickly:

- o lamp driver circuit needs tuning. Instrument should not be used in field.
- o lamp needs replacing. Install new lamp.

1.3 LCD always reads "1" except at span setting 0:

- o instrument should not be in use in the field.

1.4 LCD reading fluctuates randomly:

- o span setting too high. Reduce span setting.
- o loose detector cover. Hand tighten detector cover.

1.5 Reconnect Battery:

- o remove two hex socket screws securing handle to control housing.
- o remove handle from control housing by gently rocking handle. Be careful of 2,1/4-inch plastic sealing washers.
- o inspect and secure battery connector on control circuit board.
- o replace two hex socket screws in handle bulkhead.
- o slip plastic sealing washers over screws.
- o tighten screws to secure handle to control housing.

1.6 Install New Lamp

- o follow maintenance instructions (Appendix E) to remove lamp.
- o clean new lamp window with a lint-free tissue moistened with methanol.
- o dry lamp window with a clean tissue.
- o assemble TIP II according to Appendix E.

APPENDIX F, Continued
TIP TROUBLESHOOTING AND MINOR REPAIR PROCEDURE

1.7 Repair or Replace Detector Cell

- follow maintenance instructions (Appendix F) to remove detector cell.
- measure resistance between red and yellow wires. Resistance should be above 10 Megohms.
- if resistance is below 10 Megohms, look for a short at wire connections or between fine wire mesh and stainless steel plate (with small inlet hole).
- clean detector cell in methanol in ultrasonic cleaner.
- dry detector cell overnight at 50 degrees C (125 degrees F).
- install detector cell according to Appendix F.
- install detector cover.

APPENDIX
C

APPENDIX C

Site Health and Safety Documentation Forms

BURLINGTON ENVIRONMENTAL

H&S FORM 214-1

SITE SAFETY ORIENTATION MEETING RECORD

Document Serial Number H&SB

Project: PH I RI - PASCO LANDFILL

Location: PASCO, WASHINGTON

Project Number: 624419

Each individual signed below acknowledges that they have received a verbal site safety orientation briefing for authorized on-site activities. They have been informed of site hazards and safety protocols applicable to their responsibilities. A copy of the Site Safety Plan has also been made available for their review. Each individual signed below agrees to comply with site safety protocols as presented by Burlington Environmental Inc. health and safety representatives.

	NAME	SIGNATURE	COMPANY
1.			
2.			
3.			
4.			
5.			
6.			

This class was presented by _____
Signature

on _____.
Date

01/89/8269s

BURLINGTON ENVIRONMENTAL

H&S FORM 214-2

SITE SAFETY ORIENTATION MEETING RECORD

Document Serial Number H&SA

Project: PH I RI - PASCO LANDFILL

Location: PASCO, WASHINGTON

Project Number: 624419

I acknowledge that I have received a verbal site safety orientation briefing for authorized on-site activities. I have been informed of site hazards and safety protocols applicable to my responsibilities. A copy of the Site Safety Plan has also been made available for my review. I agree to comply with site safety protocols as presented by Burlington Environmental Inc., health and safety representatives.

Signature	Company	Date

This orientation was presented by _____
Signature

on _____
Date

01/89/8269s

BURLINGTON
ENVIRONMENTAL

SITE SAFETY ORIENTATION MEETING RECORD

Document Serial Number H&SC

Project: PH I RI - PASCO LANDFILL

Location: PASCO, WASHINGTON

Project Number: 624419 Work Activity:

Date: Time:

Presented By:

Attendees:

	Name/Signature	Company	Position
1.			
2.			
3.			
4.			
5.			
6.			

NOV/87/8159s/1

BURLINGTON
ENVIRONMENTAL

DAILY SITE SAFETY MEETING RECORD

Document Serial Number DSM-
Project Number 624419

Date: _____

Project: PH I RI - PASCO LANDFILL

Location: PASCO, WASHINGTON

Site Safety Officer/Meeting Leader: _____
(Signature)

Attendees (Signatures):

1) _____ 2) _____ 3) _____

4) _____ 5) _____ 6) _____

7) _____ 8) _____ 9) _____

Work Areas: _____

Work Tasks: _____

Hazards: _____

Personnel Protective Equipment: _____

Air Monitoring Requirements: _____

Decontamination Procedures: _____

BURLINGTON ENVIRONMENTAL

Document Serial Number H&SE
Sheet ____ of ____

BURLINGTON
ON-SITE RESPIRATOR FIT TEST RECORD

Project: PH I RI - PASCO LANDFILL

Location: PASCO, WASHINGTON

Project Number: 624419 Work Activity: _____

Date: _____ Time: _____

Administrator: _____ _____
(Name) (Signature)

Method/Testing Agent:

_____ Hood With Irritant Smoke _____ Isoamyl Acetate (Banana Oil) Ampule

Product: _____
Descriptor (Brand) (Mfg./Part Number) (Batch/Lot Number)

Employees:

Name/Signature	Company/Position	Mask Fitted
1.		
2.		
3.		
4.		
5.		
6.		

BURLINGTON ENVIRONMENTAL

Document Serial Number H&SF _____

BURLINGTON
RESPIRATOR FIT TEST RECORD

Employee: _____ Date: _____

Location: _____

_____

Administrator: _____, _____
(Name) (Signature)

Reason for Test: _____ New Mask _____ Mask Repaired
_____ QA/QC Inspection _____ Re-Certification _____ Project Start

MASK FITTED: _____, _____, _____
(Manufacturer) (Style Name) (Model Number)

_____, _____, _____
(Material) (Size) (Configuration)

_____
(Comments)

Cartridge(s) Used: _____, _____, _____ Organic Vapor (OV)
(Quantity) (Mfg. Number)

High Efficiency Particulate/
_____ Aerosol Filter (HEPA) _____ OVHEPA _____ OVHEPA With Acid Gas

METHOD: _____ Quantitative _____ Qualitative

_____ Ambient Air _____ Head Hood _____ Full Hood _____ Closed Chamber

EQUIPMENT USED: _____ Portacount _____ Portacount With Recorder
_____ Aspirator Bulb With Smoke Tube
_____ Chemical Ampule
_____ Chemical-Saturated Swab

TESTING AGENT: _____ Ambient Air (Dust) _____ Visible Smoke
_____ Irritant Smoke _____ Isoamyl Acetate (Banana Oil)

Product Descriptor _____, _____, _____
(Brand) (Mfg. Number) (Batch/Lot No. If Applicable)

FIT TEST RESULT: _____ Pass _____ Fail _____ Pass Re-Test
Portacount Fit Factor Setting _____
Strip Chart Run: _____ Yes _____ No

Administrator Comments: _____

_____

I, _____, acknowledge that I have been fit tested,
(Employee Signature)
as documented above, on _____.
(Date)

SERIAL NO. H&SG _____

BURLINGTON ENVIRONMENTAL

SUPERVISOR'S ACCIDENT/INJURY INVESTIGATION REPORT

ACCIDENT TYPE: INJURY ☐ VEHICLE ☐ PROPERTY ☐ NEAR MISS ☐

NAME OF INJURED PERSON: _____

DEPARTMENT TO WHICH INJURED PERSON IS ASSIGNED: _____

LENGTH OF EMPLOYMENT: _____ AGE _____

LENGTH OF TIME ON JOB ON WHICH PERSON WAS INJURED: _____

LOST TIME: YES _____ NO _____

DATE OF ACCIDENT: _____ DATE INJURY REPORTED: _____

TIME OF ACCIDENT: _____ AM or PM DAY OF WEEK: _____

DOCTOR TREATED: _____ FIRST AID ONLY: _____

NAME OF HOSPITAL OR CLINIC: _____

EXACT LOCATION AT WHICH ACCIDENT OCCURRED: _____

SUPERVISOR OF INJURY EMPLOYEE: _____

WITNESS: _____

WAS THE SCENE OF THE ACCIDENT INVESTIGATED BEFORE COMPLETING THIS REPORT?

YES _____ NO _____

EMPLOYEE'S DESCRIPTION OF ACCIDENT AND SUPERVISOR'S COMMENTS: _____

_____

_____

_____

_____

_____

_____

(OVER)

Body Part Affected

_____ Head, Face
_____ Eye(s) R L
_____ Neck, Shoulder
_____ Arms, Elbows R L
_____ Wrist, Hands R L
_____ Thumbs, Fingers R L
_____ Back
_____ Chest, Lower Trunk
_____ Ribs
_____ Hips
_____ Legs/Knee R L
_____ Foot/Toes R L

Type of Injury

_____ Burn
_____ Cut
_____ Strain, Sprain
_____ Fracture
_____ Amputation
_____ Bruise
_____ Foreign Body
_____ Abrasion
_____ Glass Cut
_____ Other _____

DESCRIBE UNSAFE ACT OR UNSAFE CONDITION INVOLVED.
IDENTIFY BY CHECKING (✓) APPROPRIATE LINES BELOW.
CHECK ALL UNSAFE ACTS INVOLVED (CHECK ONE OR MORE).

_____ Working without Authority
_____ Assuming Hazardous Position
_____ Failure to Lock Out Equipment
_____ Making Safety Devices Inoperative
_____ Violation of Instructions
_____ Failure to use Personal Protective Equipment
_____ Unsafe Piling of Materials
_____ Unsafe Material Handling
_____ Horseplay
_____ Using Improper Tools/Appliances
_____ Failure to Follow Safety Rules
_____ Other _____

CHECK ALL UNSAFE CONDITIONS INVOLVED (CHECK ONE OR MORE).

_____ Improperly Guarded Equipment
_____ Improper Illumination
_____ Failure of Machinery, Equipment or Materials
_____ Equipment Not Locked Out
_____ Poor Housekeeping
_____ Other _____

CHECK SPECIFIC INJURY CAUSES (ONE OR MORE).

_____ Struck by Falling Objects
_____ Struck by Splashing Material
_____ Struck Against Material
_____ Caught in Equipment
_____ Struck Against Stationary Object or Equipment
_____ Struck Against Moving Object or Equipment
_____ Caught Between Material
_____ Caught Between Equipment
_____ Caught Between Material & Equipment
_____ Slipping, Tripping, Falling
_____ Exploding Container
_____ Struck by Tool or Equipment
_____ Struck by Flying Object
_____ Struck Against Tool
_____ Fire
_____ Caught Between Tool
_____ Caught Between Tool & Equipment
_____ Other _____

AS A SUPERVISOR, WHAT CORRECTIVE ACTION DO YOU RECOMMEND OR HAVE YOU TAKEN TO PREVENT A RECURRENCE OF THIS INJURY? _____

_____

_____

DATE OF REPORT: _____

SUPERVISOR: _____

PLANT MANAGER: _____

SAFETY DEPARTMENT: _____

APPENDIX
D

APPENDIX D

Health and Safety Operating Procedures #325

General Safety Rules for Drill Rig Operations

PURPOSE

The purpose of this procedure is to provide general rules that, when followed, will facilitate safe work practices during drilling operations.

REFERENCES

U.S. Environmental Protection Agency - Standard Operating Safety Guides, November 1984.

Occupational Safety and Health Guidance Manual For Hazardous Waste Site Activities

OSHA Regulation, 29 CFR 1926. 552. - Material Hoists, Personnel Hoists and Elevators

D.O.T. (Department of Transportation) driver safety regulations.

H&S Procedure 131 - Incident Reporting

H&S Procedure 301 - Minimum Health and Safety Requirements

H&S Procedure 339 - Reporting Motor Vehicle Accidents or Damage

H&S Procedure 345 - Underground Utilities

H&S Procedure 353 - Portable Fire Extinguishers

H&S Procedure 358 - Welding, Cutting and Brazing

H&S Procedure 501 - Health and Safety Guidance Documents

EQUIPMENT

Hard Hat	Safety Glasses
Hearing Protection	Steel Toe Shoes
Safety Belt	Work Gloves

FORMS

None

RESPONSIBILITIES

Department Managers, drillers and the Health and Safety Department have responsibilities to implement this procedure as listed below.

Department Manager:

1. Require that drillers and drillers helpers be trained and competent in safe work practices before they are permitted to work on a drill rig.

2. Ensure that the provisions of this procedure are carried out.

3. Require all departmental personnel to meet the health and safety requirements of H&S Procedure 301, Minimum Health and Safety Requirements.

4. Refer technical questions concerning H&S issues to the H&S Department.

Driller:

1. Perform drilling operations in a safe manner using good judgment at all times. Refrain from any activity that might endanger yourself or fellow workers. **HORSEPLAY, PRACTICAL JOKES, AND FIGHTING WILL NOT BE TOLERATED!**

2. Report any observed unsafe condition or act in a timely manner.

3. Report all injuries, no matter how slight, at once.

4. Report all safety incidents in accordance with H&S Procedure 131 - Incident Reporting.

5. Report roadway accidents to vehicles and drill rigs in accordance with H&S Procedure 339 - Reporting Motor Vehicle Accidents and Damage.

6. Abide by the H&S requirements set forth in this procedure and other applicable H&S procedures.

7. Consult with the Department Manager when H&S questions arise.

H&S Department:

1. Provide health and safety training for drillers and drillers helpers.

2. Provide guidance and technical support to the Exploration Department Manager and to the Exploration Department personnel.

3. Maintain this procedure.

DISCUSSION

The following procedure provides basic safe work rules that are to be followed during drilling operations. The procedure does not address all hazards that may be encountered during drilling operations; therefore, it is imperative that all personnel use good judgment and be safety conscious at all times.

PROCEDURE

Perform the items listed below.

1. General Precautions

1.1 All personnel working on or around drill rigs shall be trained as prescribed by Mathes requirements outlined in H&S Procedure 211.

1.2 Wear required protective clothing for general drilling hazards, including hard hats, gloves, safety glasses, safety footwear, hearing protection, safety belts, etc. Refer to H&S Procedure 301 - Minimum Health and Safety Requirements.

1.3 All workers within the vicinity of the drill rig shall wear hard hats during drill rig operations and rig setup/take down.

1.4 All drilling personnel assigned to a rig should be familiar with the specific limitations and safety devices peculiar to that rig and its support equipment.

1.5 Drill rig equipment should be inspected and maintained on a regular basis. The frequency of inspections and maintenance shall be dependent on specific use and field conditions.

1.6 Protect the public by proper use of barricades, warning signs or cones, and ramps over pipes. Caution against unauthorized access into the vicinity of the rig when in operation.

1.7 When working in adverse weather conditions, wear suitable clothing and follow safe work practices appropriate for the hazards encountered.

1.8 Provide a first aid kit, a fire extinguisher, and roadway emergency markers sufficient to service the drilling rig and crew, and support vehicles.

1.9 Do not drill or allow any drilling equipment to come closer than 20 feet from overhead electrical lines unless you know that the electrical power has been de-energized or unless you contact the Exploration Department Manager.

2. Movement of Drill Rigs and Drilling Equipment

2.1 Before moving a rig, the operator must do the following:

In general,

- o know the controls and limitations of your equipment;
- o do not allow riders on equipment;
- o always be sure bystanders are clear of equipment; and
- o check the brakes of the truck/carrier, especially if the terrain along the route of travel is rough or sloped.

In rough or steep terrain,

- o to the extent practical walk the planned route of travel and inspect it for depressions, gullies, ruts, and other obstacles;
- o discharge all passengers before moving on rough or steep terrain;
- o engage the front axle (on 4x4, 6x6, etc. vehicles) before traversing rough or steep terrain; and

- o when moving up a steep grade or slope, anchor a winch line to the top of the slope.

2.2 Never try to move any equipment until you are completely familiar with all the controls.

2.3 The drilling rig shall not be moved from one location to the next with the mast raised.

2.4 Driving drill rigs along the sides of hills should be avoided. Drilling tools on the rig changes the center of gravity such that a rollover is likely.

2.5 Logs, ditches, road curbs, and other long and horizontal obstacles should be normally approached and driven over squarely, not at an angle.

2.6 When close lateral or overhead clearance is encountered, the driver of the rig should be guided by another person on the ground.

2.7 Loads on the drill rig and truck must be tied down while the truck is moving, and the mast must be in the fully lowered position.

2.8 Never leave a drill rig idling when it is on any incline or on loose material; the vibration may put the machine in motion.

2.9 Use only the proper cable when moving a piece of equipment. Do not straddle or reach across a cable when wenching or pulling equipment.

3. Rig Set-Up

3.1 Each drilling location is to be inspected and approved as safe for drilling. The inspection will be for buried utility pipes, wires, conduits, tanks or other potentially dangerous structures, overhead powerlines, stability of soil, and other obstructions.

It is always best to obtain clearance for underground utilities and other obstructions from site owners or public utility representatives. In Illinois, call

J.U.L.I.E., (800) 892-0123. Some other states and major cities have similar underground utility location clearance hotlines. Call them, or the local utility companies to get drilling locations cleared. Refer to H&S Procedure 345 - Underground Utilities.

3.2 When drilling near suspected electrical hazards, the rig should be grounded with a ground wire attached to a ground rod.

3.3 All brakes and/or locks must be set before drilling begins. If the rig is positioned on a steep grade and leveling of the ground is impossible or impractical, the wheel of the transport vehicle should be blocked and other means employed to prevent the rig from moving or topping over.

3.4 Use sufficient blocking (under rig jacks) and guy wires where necessary.

3.5 Before the mast is raised:

- o inspect pulley sheaves for wear and cable/rope positioning;
- o be certain the brakes work and all hoses and fittings are in good order;
- o raise the derrick a few inches in order to check the brakes; and
- o always check for overhead power lines.

3.6 After the mast is raised and secured, all guard rails, catwalks, and guards (over pulleys, shafts, gears, and engine drive pumps) should be properly installed.

3.7 All mud pits, settling ponds, or open trenches should be barricaded.

3.8 Set-up work to be done above six feet on the mast requires the use of a safety belt, or the mast must be lowered.

3.9 Always clear away tree limbs and debris from the drilling site.

4. Drilling

4.1 Special attention should be paid to the following general safety rules:

- o do not rush. Haste is a common cause of accidents. Speed will be developed with work experience;
- o ANSI-approved hard hats, safety glasses, and steel-toed, steel shank, thick-soled leather or rubber safety boots with an eight-inch (minimum) ankle height and traction cleats must be worn during all drilling activities. Tennis shoes will not be allowed;
- o wear gloves when handling cable, rods, or any sharp or splintery materials. Rubber gloves should always be worn when handling cement or cement grout;
- o know where everyone is at all times;
- o be sure people are clear of moving parts before starting equipment;
- o know the location(s) and correct operation of the emergency shut-down (kill) switch(es) on the rig;
- o communicate effectively, especially under high noise conditions;
- o do not wear loose clothing or jewelry around moving machinery. Shirts and jackets should be fastened, and jewelry (especially rings) should be removed before work begins;
- o observe proper lifting techniques;
- o use tools only for the job they were intended to do;
- o never use gasoline or any other combustible solvent as a cleaning agent. Combustible solvents could result in a fire or explosion hazard;

- o always have a fire extinguisher readily available to put out small rig fires;
- o use a safety belt while working at any height above six feet in the derrick or on top of the rig;
- o do not perform maintenance or refuel while the rig is running;
- o never ride on, or jump from moving equipment;
- o all high pressure hoses should have safety chains or tie down cables;
- o all hooks shall have safety latches and be checked between borings;
- o do not remove any blocking or jacks under rig while machine is drilling; and
- o stand clear of cable as much as possible while pulling pipe or while rig is under heavy strain.

4.2 Incorporate safety meetings to encourage on the job safety. Specifically:

- o regularly scheduled safety meetings shall be held at least once a month for all supervisors on the project; and
- o at least one safety meeting shall be conducted weekly by drill foreman with their respective crew.

4.3 Exercise proper lifting techniques to minimize back injury. When lifting materials, keep your back straight. Bend your knees and lift with your legs. Get help if the load is heavy or awkward.

General guidelines for lifting are:

- o get a good footing;
- o place feet about shoulder width apart;
- o bend at the knees to grasp the weight;

- o keep your back straight, do not bend over;
- o get a firm grip;
- o keep your back as straight as possible; and
- o lift the load by gradually straightening the legs.

When putting down a load, reverse the procedure.

4.4 Do not operate the rig in an electrical (lightning) storm. If drilling when a storm approaches, stop drilling and lower the mast if possible. Do not stay near rig if the mast cannot be lowered.

4.5 Do not operate a cathead winch in the rain or if the cathead rope gets wet. If the rope catches and the drive-spoon hammer takes off, do not attempt to stop it or break its fall. Rather, quickly get well clear of the fall area.

4.6 In cold weather, hydraulic fluid should be thinned prior to use. This can be accomplished by allowing the fluid to recirculate for a few minutes before engaging any hydraulic-driven system on the rig.

4.7 When racking drill rods for rotary drilling/sampling, rods shall not be racked more than 1.5 times the height of the mast.

4.8 Be on guard for pinch and shear hazards for fingers and toes -- especially around the drill string.

4.9 Practice good housekeeping:

- o the work area should be kept as clear as possible at all times;
- o keep excess spoil material and unneeded equipment well out of the way;
- o keep walkways clear; and
- o tools should be kept up off the ground.

4.10 When jump-starting equipment, be sure of battery terminal connections. Connect positive first, then negative. Batteries can explode, spraying acid to eyes and skin.

4.11 Lighting on the site or rig shall be properly installed and sufficient in quantity to provide adequate illumination for night work. All receptacles shall be backed up by a ground fault circuit interrupter.

4.12 Do not ride on hook ropes or other traveling lines on the rig.

4.13 Do not climb the rig mast while the rig is drilling.

4.14 Noise protection must be worn by employees working when the drilling equipment is operating.

4.15 Wastewater and drilling fluids must be properly diverted or contained. In cold weather, watch for icy conditions.

4.16 Use caution during welding activities. Wear welding goggles and gloves. Properly ground arc-welding equipment. Properly vent PVC solvent glue vapors from installed well casings before cutting or welding the casings. Refer to H&S Procedure 358 - Welding, Cutting and Brazing.

4.17 When moving or hoisting stabilizers or drill collars, tag lines should always be used. A helper shall not use his hands to hold or control a stabilizer or drill collar. Instead loop a rope around it and hold onto both ends of the rope.

4.18 Core extracting. Many accidents take place when the core is being extracted. The safest method of removing core from a core barrel is to:

- o hoist the inner barrel from the outer barrel using the appropriate hoisting plug or method;

- o lay the inner barrel on two saw horses and break the lifter case from the barrel;
- o lay the bottom end of the inner barrel in a core tray; and
- o raise the top end up and allow the core to slide out into the core tray. At no time should your hands be under the end of the core. The core is sometimes broken and sharp and may cut your hands.

4.19 Do not use pipe wrenches that are bent or cracked.

4.20 When breaking drill rods, at no time should your hands be placed on the back side of a pipe wrench being used to backup drill rods. Serious injury to hands and fingers could result.

4.21 AT NO TIME shall an employee ever touch a rotating auger or drill rod.

5. Safe Use of Augers

5.1 Never place hands or fingers under the bottom of an auger flight when hoisting the flight over the top of another flight in the ground or above any other hard surface, such as the drill rig platform.

5.2 Never place feet under the auger flight while the flight is being hoisted.

5.3 When an auger is rotating, stay clear of the auger and other rotating components of the drill dig. Never reach behind or around a rotating auger for any reason.

5.4 Move auger cuttings away from the auger with a long-handled shovel or spade; never use hands or feet.

5.5 Never clean an auger attached to the drill rig unless the transmission is in neutral or the engine is off, and the auger has stopped rotating.

6. Fire Safety

6.1 Know where the fire extinguishers are and how to use them. Check the charge condition before the start of project activities and periodically thereafter. Refer to H&S Procedure 353 - Portable Fire Extinguishers.

6.2 Fires and open flame devices shall not be left unattended.

6.3 All oil-fired portable heaters (salamanders) will be shut off anytime they are left unattended.

6.4 Smoking shall be prohibited in all areas where flammable or combustible materials exist.

6.5 When drilling in areas with a potential of producing flammable gases, all flame and heat producing devices shall be extinguished.

6.6 When drilling in old works (mine void areas) all flame and heat producing devices shall be extinguished a minimum of 10 feet before drilling into the area of the old works.

6.7 Be sure exhaust from all machines is directed away from all flammable materials including hoses and plastic tarps which may be on the rig deck.

6.8 Never check a battery with a match or an open flame.

6.9 All refueling of equipment will be done only after the equipment has been shut off. Follow guidelines in Point 6.10.

6.10 Proper handling of fuels:

- o never use gasoline to start a fire;
- o never wash clothing or rags with gasoline;
- o if gasoline is spilled on clothing, it should be changed;

- o gasoline should only be transported and stored in approved metal containers;
- o never use a rag as a replacement for a gas cap for a gas can or tank;
- o never store gasoline indoors;
- o never refuel a hot engine;
- o always use a funnel when refueling to avoid spillage;
- o NEVER smoke while refueling equipment; and
- o all fuel leaks shall be repaired immediately.

7. Hazardous Substances and Atmospheres

7.1 All persons required to handle or use any harmful substances shall receive instructions regarding the safe handling, potential hazards, personnel hygiene, protective equipment, disposal, and other protective measures involved or required, including emergency response.

7.2 Drilling projects with potential health or safety hazards from chemical contaminants should be health and safety reviewed in accordance with H&S Procedure 121.

7.3 Chemical hazards that originate from substances used as project or work supplies shall be addressed in job-specific, "Right-To Know" training in accordance with OSHA's Hazard Communication Act and H&S Procedure 221.

7.4 It is the employee's responsibility to comply with the rules or guidelines that apply when working in dangerous or potentially dangerous areas. Refer to applicable health and safety guidance documents in accordance with H&S Procedure 501.

7.5 Drilling operations are sometimes subject to health and safety hazards from borehole emissions of toxic or flammable vapors, especially in cases of environmental contamination. Specific hazards common to our drilling activities include:

- o gasoline;
- o hydrogen sulfide; and
- o methane or natural gas.

These hazards are particularly serious when drilling in a physically confining area where ventilation is poor and vapors can accumulate to dangerous concentrations.

7.6 Carbon monoxide (CO) generated in drill rig and support equipment exhaust may pose an inhalation hazard when drilling in a confined area, such as inside a building. Provide adequate ventilation for any gasoline engine-powered equipment used indoors.

7.7 When drilling on a contaminated site, containerize drilling spoils and fluids suspected to be contaminated as prescribed in the work plan.

7.8 If drilling on a contaminated site, properly decontaminate all drilling equipment, as required, before leaving. This includes drilling tools, pipe, pumping equipment, and mud-pits, in addition to the drill rig and drill string.

8. Leaving the Site

8.1 Make sure all excavations, settling ponds, etc., are properly backfilled.

8.2 Clean up waste materials from drilling operations, such as discarded containers, hoses, damaged tools or blocking, and wasted pipe and casing, etc. Dispose of properly.

9. Equipment Maintenance Safety

9.1 All drilling equipment must be inspected and maintained on a regular, timely basis to keep the equipment in safe working condition. The emergency shut-off "kill" switch should be tested for correct operation on a daily basis.

9.2 Do not attempt to repair a piece of equipment while the machine is running.

9.3 Rig masts should be serviced or repaired in the fully lowered position only, when at all possible.

9.4 Use a safety belt while working at any height above six feet on the mast or on top of the rig.

9.5 When working on a derrick or tower always double check the work area for tools when the job is complete. Loose tools can fall on personnel when the tower is raised.

9.6 If a safety guard is removed for service work, replace it before the equipment is operated.

9.7 Maintenance work that must be performed in a chemically contaminated location (such as in the hot zone of a hazardous waste site), must be done in personal protective equipment appropriate for the chemical exposure hazard anticipated.

END OF H&S PROCEDURE 325

APPENDIX
E

APPENDIX E

Health and Safety Operating Procedures #445

Use, Calibration, and Maintenance of
the Combustible Gas Indicator and
Manufacturer's Instructions for Calibration
of Hydrogen Sulfide Detector

PURPOSE

This procedure describes a uniform method for use, calibration, and maintenance of Combustible Gas Indicators (CGI's) and combination combustible gas and oxygen indicators. This procedure is to be followed by personnel using such instruments.

REFERENCES

Instruction Manual for Gastech Model GX-3, Combination Combustible Gas/Oxygen Indicator and Alarm, Gastech, Incorporated.

Instruction Manual for Gastech Model GP-82, Combustible Gas Indicator.

Instruction Manual for Gastech Model 1314, Hydrocarbon Super Surveyor, Gastech, Incorporated.

Instruction Manual, Industrial Scientific Model HMX271, Hydrogen Sulfide, Combustible Gas, Oxygen Monitor.

Instrument-Specific Logbook.

Air Quality Monitoring Instrumentation - General Use, Calibration, and Maintenance Program, Mathes H & S Procedure 441.

EQUIPMENT

CGI Equipment Case and contents.

FORMS

None.

DEFINITIONS

Biannual Calibration - a quantitative determination of the instruments accuracy that is to be done at least once every six months. This is done by comparing instrument readings with a known concentration of some gas.

Field Calibration - a quantitative determination of the instruments accuracy that is performed at least once a week. This is also done by comparing instrument readings to a known concentration of gas.

Functional Check - A qualitative check performed to determine if the instrument will respond to a given substance which the instrument is capable of detecting. A response check should be done prior to each use of the instrument to verify that the instrument is working.

RESPONSIBILITIES

The Site Supervisor, Department Manager, Health and Safety (H&S) Department, and instrument user have the following responsibilities, supplemental to those specified in Mathes H&S Procedure 441, to implement this procedure.

Site Supervisor:

1. Maintain the instrument as required.

2. Use an operational instrument on the job site.

3. The duty to use and maintain the instrument may be delegated to a Site Safety Officer, if available.

Department Manager:

1. Submit the instrument at least every six months for a biannual calibration by a qualified technician or the manufacturer.

2. Assign only qualified technicians to operate the instrument.

H&S Department:

1. Review instrument use on field projects to determine appropriate action levels.

2. Audit selected field projects to determine the manner in which the instrument is used.

3. Conduct a training class, upon request, for field technicians.

4. Inspect instruments as judged appropriate or necessary.

Instrument User:

1. Use the instrument in accordance with manufacturers recommendations, as specified in the instrument manual.

2. Attend a training class on the proper use, limitations, calibration, and maintenance of the instrument.

3. Use, calibrate, and maintain the instrument in accordance with this procedure and H&S Procedure 441.

4. Follow the site-specific instrument use specifications and protocols provided by the H&S Department.

5. Request technical assistance in implementing this procedure, when needed.

DISCUSSION

Direct reading instruments similar to the CGI are used to measure the airborne concentrations of organic vapors which, if in a sufficient concentration, may create a hazardous situation. The CGI is principally used when dealing with flammable or combustible liquids that could cause an explosive environment.

Mathes employees utilize several different models of CGI's during field operations. This procedure lists the basic steps that are to be followed during equipment check out, use, and calibration of any model of CGI. Instrument specific instructions for the check out, calibration, and maintenance of the various models of CGI's used by Mathes personnel are included in the Appendices to this procedure.

APPENDICES

Appendix A - Instrument Specific Instuctions for the Gastech Model GX-3A.

Appendix B - Instrument Specific Instructions for the Gastech Model GP-82.

Appendix C - Instrument Specific Instructions for the Gastech Model 1314.

Appendix D - Instrument Specific Instructions for the Industrial Scientific Model HMX271.

PROCEDURE

Perform the items listed below.

1. Equipment Checkout - (Done prior to removing the CGI from the equipment room).

1.1 Inspect the CGI equipment case to see if the necessary equipment is available. The equipment which is to accompany the instrument is specified in section one of the appropriate Appendix.

1.2 Perform the assembly and functional checks outlined in Section 2.0 of the appropriate Appendix to this procedure.

2. Calibration - (to be done prior to using the instrument).

2.1 Inspect the instrument logbook to confirm that the instrument has been calibrated within the last six months. If the instrument has not been calibrated within the last six months; perform the biannual calibration described in Section 4 of the appropriate Appendix.

2.2 Inspect the instrument logbook to confirm that the instrument has been calibrated within the last week. If the instrument has not been calibrated within the last week perform the field calibration described in Section 3 of the appropriate Appendix.

3. Operation - Operate the instrument only after all of the above steps have been taken.

3.1 Operate the instrument in accordance with the instructions given in Section 5 of the appropriate Appendix.

4. Maintenance

4.1 Instruments must be maintained in a clean and undamaged condition. Wipe any dirt or debris from the instrument after use, and perform or obtain repairs, when needed.

4.2 All other maintenance shall be performed in accordance with the specific instructions which can be found in the manufacturers instruction manual.

5. Rental Equipment

5.1 Refer to the instruction manual of the specific instrument used to determine the calibration, use, and maintenance procedures to be followed.

Note: If no instruction manual is available for a powered-flow, rental CGI the Instrument Specific Instructions for the Gastech Model GX-3A which are found in Appendix A will be of assistance since the Model GX-3A is a power flow type detector.

If no instruction manual is available for a passive type detector then the Instrument Specific Instructions for the Gastech Model GP-82 will be of assistance since the GP-82 is a passive detector.

EXCEPTIONS None

END OF H&S PROCEDURE 445

Appendix A

INSTRUMENT SPECIFIC INSTRUCTIONS FOR THE GASTECH MODEL GX-3A COMBUSTIBLE GAS/OXYGEN INDICATOR AND ALARM (POWER FLOW DETECTOR)

1 Equipment

The following equipment should be included in the equipment case:

- o readout assembly;
- o probe with in-line filter;
- o carrying case;
- o instrument logbook;
- o 1.5-liter/minute flow rate lecture bottle regulator with tubing;
- o marking pen with organic solvent (used to check instrument response);
- o calibration gas cylinder(s) - specific type based on application;
- o battery charger; and
- o spare alkaline batteries.

2 Assembly and Functional Checks

The following sequence of events should be followed in assembly and performing operational checks of the instrument.

2.1 Screw the probe assembly into the readout assembly. Turn the instrument on. When the instrument is turned on the audible alarm signal and either alarm light may come on, if this occurs push the alarm reset.

2.2 Check battery voltage by placing switch in "volt check" position. Instrument should rise to black band near top of scale. If it reads below the V, batteries need recharging for full capacity. Do not attempt to use the instrument if the reading is below the lower end of the black scale.

2.3 Verify pump operation by listening for sound of internal pump. Hold finger over sample inlet and observe that the pump slows down or stops. If pump does not slow down appreciably, there is leakage in the pump valves or elsewhere in the system, and reliable gas indication may be impossible.

2.4 Check oxygen setting by turning switch to oxygen position. Meter should rise to upper portion of scale. Set to 21 percent oxygen (red mark) by lifting and turning the calibrate knob.

2.5 Check combustibles zero setting by turning switch to combustibles position. Meter should read close to zero. Lift and turn zero knob to bring reading exactly to zero.

2.6 Admit a sample of some combustible gas to end of probe, and confirm that combustibles alarm and indicating circuits are functional. This is a response check of the instrument.

2.7 Gently blow into the instrument probe, being careful not to touch your mouth to the tubing. The oxygen content should drop to approximately 17 percent. The alarm should sound at 19.5 percent O_2. Adjust the alarm in accordance with the manufacturers instructions if the desired reading are not achieved.

2.8 The instrument is now adjusted and ready to use provided that it has been adequately calibrated within the last six months and within the last week.

3 Field Calibration

Weekly calibrations shall be recorded in the instrument logbook and shall be performed as follows.

3.1 Select a calibration gas to confirm that the combustible detector is in working order. The chemical and physical properties of the calibration gas chosen must closely resemble the anticipated site contaminant, so that instrument response for the two gases will be similar.

Note: Methane, heptane or hexane may be used as calibration gases. For gasoline contamination only heptane or hexane should be used for a calibration gas, Do not use methane for gasoline jobs.

3.2 Select the combustible response made.

3.3 Connect the calibration gas to the instrument probe and open the regulator valve.

Note: The combustible alarm should sound at 20 percent LEL. Adjust the alarm in accordance with the manufacturers instructions if such an adjustment is required.

3.4 Record the instrument reading in the calibration logbook. If the response is off by greater than 10 percent of the ideal response, adjust the instrument in accordance with the manufacturers instructions.

3.5 Select the oxygen response mode.

3.6 Gently blow into the instrument probe, being careful not to touch your mouth to the tubing. The oxygen content should drop to approximately 17 percent; the alarm should sound at 19.5 percent oxygen. Adjust the alarm in accordance with the manufacturers instructions.

3.7 Record the observed response in the calibration logbook.

3.8 Any deviation from, or problems in achieving the ideal response should be recorded in the log.

4 Biannual Calibration

These calibrations shall be performed at least once every six months and the results shall be recorded in the instrument logbook. Biannual calibrations shall be performed as follows:

4.1 Select a calibration gas with chemical and physical properties similar to those of the anticipated contaminant to be sampled.

4.2 Select the combustible response mode.

4.3 Connect the calibration gas to the instrument probe and open the regulator valve.

4.4 Record the instrument reading in the calibration logbook. If the response is off by greater than 10 percent of the ideal response, adjust the instrument in accordance with the manufacturers instructions.

4.5 Select a second concentration of calibration gas (same chemical as previously used but at a concentration of less than 1000 ppm). This is to test the ppm scale.

4.6 Connect the gas cylinder to the instrument. Open the regulator.

4.7 Perform oxygen calibration.

4.8 Record the observed response in the calibration logbook. If the response is off by greater than 10 percent of the ideal response, adjust the calibration potentiometers inside the instrument case in accordance with the manufacturers specifications.

5 Operation*

5.1 Press red button to turn the instrument on and reset the alarm it is comes on.

5.2 Turn instrument switch to desired scale.

5.3 Hold probe within space to be tested. Watch meter and observe maximum reading after about 15 seconds.

5.4 If desired to read both oxygen and combustibles, turn the switch to both positions, one after the other.

5.5 Regardless of switch position a combustibles concentration above the combustibles alarm setting will activate the combustibles alarm light and the audible tone. Likewise, an oxygen concentration below the oxygen alarm setting will activate the oxygen alarm light and the audible tone regardless of operating mode. See front covers for settings originally used in adjusting this instrument.

5.6 After completion of test, remove probe from test space, allow instrument to sample fresh air for 10 seconds and turn off by pressing black button.

*Note - 1. An oxygen concentration of less than 10 percent will cause erroneous readings on the combustibles scale.

2. Do not allow the probe tip to come in contact with any liquids. This will allow water to be drawn into the instrument which would damage the instrument.

6 Limitations

These instrument specific instructions are to be used in conjunction with H&S Procedure 445.

Appendix B

INSTRUMENT SPECIFIC INSTRUCTIONS FOR THE GASTECH MODEL GP-82 COMBUSTIBLE GAS DETECTOR (PASSIVE DETECTOR)

1 Equipment

The following equipment should be included in the equipment case.

- o instrument;
- o leather carrying case with belt attachment and wrist strap;
- o two spare size AA dry cell batteries;
- o calibration kit;
  - cylinder of calibration gas;
  - regulator;
  - flexible tygon tubing;
  - adapter cup to fit over sensors; and
- o logbook.

2 Assembly and Functional Checks

2.1 Install two AA cell batteries, button end toward display*.

2.2 While in normal air turn power switch to ON.

2.3 Observe meter reading which should be close to 00, if the instrument does not read close to zero adjust the zero screw on the side of the instrument so that the instrument reads zero.

2.4 Subject the instrument to a sample of a combustible gas to verify that the instrument is operating. Alarm should sound at 20 percent LEL. If alarm does not sound see maintenance section of instrument manual.

*Note - 1) If the batteries are low the instrument will sound a continuous steady tone.

2) Normal battery life is 10 hours when used in daylight operations. Battery life will be less when the instrument is used in a dark environment.

3 Field Calibration

Weekly calibrations shall be recorded in the instrument logbook and shall be performed as follows:

3.1 Select a calibration gas to confirm that the combustible gas indicator is in working order. The chemical and physical properties of the calibration gas chosen must closely resemble the anticipated contaminant, so that instrument response for the two gases will be similar.

Note: Methane, heptane or hexane may be used as calibration gases. For gasoline contamination only heptane or hexane should be used for a calibration gas. Do not use methane for gasoline jobs.

3.2 Turn the instrument on and set zero accurately.

3.3 Place the adaptor cup over the sensing port on the Model GP-82 and open the regulator valve on the cylinder of calibration gas. The flow rate of the cylinder should be 500 cc/min, but the instrument is not flow sensative so adjustment is not critical.

3.4 While sensor is exposed to the sample, note the instrument reading. If not correct turn the span control on the side of the instrument with a small screwdriver until the reading on the instrument matches the known value of the calibration gas.

If the span cannot be adjusted so that the instrument gives a reading consistent with the known value of calibration gas, the sensor is probably exhausted and should be replaced. (See maintenance section in the instruction manual).

4 Biannual Calibration

These calibrations shall be performed at least once every six months and the results shall be recorded in the instrument logbook. Biannual calibrations shall be performed as follows:

4.1 Select a calibration gas to confirm that the combustible gas indicator is in working order. The chemical and physical properties of the calibration gas chosen must closely resemble the anticipated contaminant, so that instrument response for the two gases is similar.

Note: Methane, heptane or hexane may be used as calibration gases. For gasoline contamination only heptane or hexane may be used for a calibration gas. Do not use methane for gasoline jobs.

4.2 Turn the instrument on and accurately set the zero.

4.3 Place the adaptor cup over the sensing port on the Model GP-82 and open the regulator valve on the cylinder of calibration gas. The flow rate of the cylinder should be 500 cc/min, but the instrument is not flow sensitive, so adjustment is not critical.

4.4 While the sensor is exposed to the sample, note the instrument reading. If the reading is not correct turn the span control located on the side of the instrument with a small screwdriver until the reading on the instrument matches the known value of the calibration gas.

4.5 Perform oxygen calibration. If the span cannot be adjusted so that the instrument gives a reading consistent with the known value of calibration gas, the sensor is probably exhausted and should be replaced. (See maintenance section in the instruction manual).

5 Operation

5.1 While in a normal air location, turn power switch to ON.

5.2 Observe meter reading which should be close to 00.

5.3 Turn zero knob on side of instrument clockwise using a fingertip or small screwdriver to bring display above 20 percent, and verify operation of alarm (pulsing audible tone plus flashing light).

5.4 Set to 00.

5.5 Instrument is now ready for use as a combustible gas indicator or monitor.

5.6 Wear the instrument on your belt or hang it in the work area in the breathing zone so that it may monitor combustible gases or vapors in the work area.

6 Limitations

These instrument specific instructions are to be used in conjunction with H&S Procedure 445, and in accordance with the manufacturers instructions.

Appendix C

INSTRUMENT SPECIFIC INSTRUCTIONS
FOR THE
GASTECH MODEL 1314
PPM/LEL GAS INDICATOR WITH OXYGEN SECTION
(POWER FLOW DETECTOR)

1 Equipment

The following equipment should be included in the equipment case.

- o detector assembly;
- o probe assembly;
- o battery charger;
- o calibration kit;
  - lecture bottle(s) of calibration gas - specific type based on application;
  - 1.5-liter/minute flow rate lecture bottle regulator with tygon tube; and
- o instrument logbook.

2 Assembly and Operational Checks

The following sequence of events should be followed during assembly and when performing operational checks of the equipment.

2.1 Attatch hose to the instrument by means of the quick release fitting.

2.2 Put PPM/LEL switch in LEL (out) position with black indicator showing, and OXY/LEL switch also in LEL (out) position.

2.3 Press power switch to turn instrument on with orange indicator dot showing. Meter will normally rise upscale and pulsing or steady alarm signal may sound. Audible hum of pump will be noticed. Cause of alarm condition can be identified by the blinking lights.

2.4 Press battery check button to check battery charge. Meter reading should be upscale of battery check mark on meter face.

2.5 Allow the instrument to warm up for approximately one minute. If the alarm sounds turn the oxygen calibration potentiometer until the alarm stops.

2.6 With the hose inlet in a gas free location, turn the zero LEL potentiometer to bring meter to "0" indication. If the zero cannot be set using the LEL/PPM zero then set the coarse zero inside the instrument. The coarse zero should be set in accordance with the instrument instruction manual.

2.7 Admit a sample of some combustible gas to the end of the probe and confirm that the combustibles mode and alarm is operating.

2.8 Put OXY/LEL switch in the OXY (in) position so that the orange indicator shows. Turn oxygen calibration potentiometer to bring meter to the O_2 CAL mark (21 percent).

Gently breathe into the instrument probe. The oxygen content should drop to approximately 17 percent. The alarm should sound at 19.5 percent O_2. Adjust the alarm in accordance with the manufacturers directions if so desired.

3 Field Calibration

Weekly calibrations shall be recorded in the logbook and performed as follows:

3.1 Select a calibration gas to confirm that the combustible gas indicator is in working order. The chemical and physical properties of the calibration gas chosen must closely resemble the anticipated contaminant so that instrument response for the two gases will be similar.

3.2 Turn instrument on and allow it to stabilize for approximately five minutes.

3.3 Open instrument case and locate the coarse zero inside the instrument on the underside of the circuit board.

3.4 Turn external zero control to center of its span. Then turn coarse zero potentiometer to bring meter to zero reading.

3.5 To calibrate the LEL range, connect calibration cylinder to the probe tip and turn the regulator on so that the instruments pump does not labor.

3.6 Record the instrument reading in the calibration logbook. If the response is off by greater than 10 percent of the ideal response,

adjust the instrument by turning the LEL SPAN potentiometer to give the desired reading.

3.7 If zero cannot be adjusted or if reading cannot be set high enough, replace detector.

4 Biannual Calibration

4.1 Select a calibration gas to confirm that the combustible gas indicator is in working order. The chemical and physical properties of the calibration gas chosen should closely resemble those of the anticipated contaminant, so that instrument response for the two contaminants will be similar.

4.2 Turn the instrument on and allow it to stabilize for approximately five minutes.

4.3 Open the instrument case and locate the coarse zero inside the instrument on the underside of the circuit board.

4.4 Turn external zero control to center of its span. Then turn coarse zero potentiometer to bring meter reading to zero.

4.5 To calibrate the LEL range connect calibration cylinder to the probe tip and turn the regulator on so that the instruments pump does not labor.

4.6 Record the instrument reading in the calibration logbook. If the response is off by greater than 10 percent of the ideal response, adjust the instrument by turning the LEL SPAN potentiometer to give desired reading.

4.7 If zero cannot be adjusted or if reading cannot be set high enough, replace detector.

4.8 Perform a calibration of the instrument in the ppm range.* Turn range switch to the ppm scale and follow the same procedure listed above.

4.9 Perform oxygen calibration using a gas of a known concentration of 0_2 in Nitrogen.

*Note - In the sensitive ppm range it is important that the humidity of the sample be the same as that of the air used for zero adjustment. If they are different, a significant offset in zero reading may be observed.

5 Operations

5.1 Press power switch in to the ON position.

5.2 Perform a battery check.

5.3 Set instrument range switch to the desired scale.

5.4 While sampling normal air (contaminant free) set zero adjustment.

5.5 Confirm that the instrument is working by sampling the tip of a marking pen containing organic solvents.

5.6 Gently exhale into the instrument to confirm that the oxygen sensor is working and to assure that the alarm is properly operating.

5.7 Sample the desired environment by placing the probe into that environment. The instrument probe should not be allowed to come in contact with liquids as this would affect instrument readings.

6 Limitations

These instrument specific instructions are to be used in conjunction with H&S Procedure 445 and in accordance with the manufacturers instructions.

Appendix D

INSTRUMENT SPECIFIC INSTRUCTIONS
FOR THE
INDUSTRIAL SCIENTIFIC MODEL HMX271
COMBINATION HYDROGEN SULFIDE, COMBUSTIBLE GAS AND OXYGEN MONITOR
(PASSIVE DETECTOR)

Discussion: This instrument is capable of monitoring for Hydrogen Sulfide. If Hydrogen Sulfide monitoring is desired see H&S Procedure 446. This procedure only addresses the use of the HMX 271 as a combustible gas indicator.

1 Equipment

The following equipment should be included in the equipment case.

- o monitor with wrist strap;
- o leather carrying case with belt strap;
- o tygon tubing with calibration cup;
- o 5/64 allen wrench;
- o calibration tool;
- o calibration gas cylinder; and
  - cylinder of pentane and oxygen regulator.

2 Assembly and Operational Checks

2.1 Back off the knobed nut that holds the calibration cover in place.

2.2 Rotate the cover so that the metal button is inserted in the oval shaped hole.

2.3 Tighten the nut until the calibration cover is flush with the case. Do not overtighten.

2.4 The monitor is ready for use as soon as the display stabilizes. (Approximately 60 seconds).

2.5 Press the percent LEL button so that the arrow on the display screen points to the percent LEL button.

*Note - The instrument simultaneously monitors for percent LEL, percent oxygen and ppm H_2S, and will alarm for any of the three regardless of the operating mode of the instrument. However, the digital display screen only displays the concentration of gas for the specific mode in which the instrument is operating.

2.6 Subject the instrument to a combustible gas to ensure that the instrument is working.

2.7 Press the percent oxygen button so that the arrow on the screen is pointing towards the percent oxygen button.

2.8 Exhale into the screened diffusion port on the rear of the instrument. The instrument reading should drop to around 16 percent oxygen and the alarm should sound. This verifies that the oxygen sensor is working.

3 Field Calibration

Weekly calibration shall be recorded in the logbook and performed as follows:

3.1 Turn instrument on, set the LEL zero by placing the instrument in the LEL mode and adjusting the Z LEL screw located under the cover plate at the base of the instrument.

3.2 Turn the calibration gas cylinder on and place the nose cup attached to the tygon tubing over the end of the instrument.

3.3 Allow the gas to flow for two minutes

3.4 With the gas still flowing, adjust the S LEL (LEL Span sensitivity) control on the base of the instrument so that the display reads the percent LEL, to the nearest percent, that is printed on the LEL calibration gas cylinder.

3.5 In a clean area known to have 20.9 percent oxygen, adjust the S OX (oxygen calibration) control so that the display reads 20.9 percent oxygen.

3.6 Record the calibration in the instrument logbook.

4 Biannual Calibration

These calibrations shall be performed at least once every six months and the results shall be recorded in the instrument logbook. Biannual calibrations shall be performed as follows:

4.1 Turn the instrument on. Set the LEL zero by placing the instrument in the LEL mode and adjusting the Z LEL screw located under the cover plate at the base of the instrument.

4.2 Turn on the calibration gas cylinder and place the nose cup, attatched to the tygon tubing, over the end of the instrument.

4.3 Allow the gas to flow for two minutes.

4.4 While the gas is still flowing, adjust the S LEL (LEL span sensitivity) control on the base of the instrument so that the display reads the percent LEL, to the nearest percent, that is printed on the LEL calibration gas cylinder.

4.5 In a clean area known to have 20.9 percent oxygen adjust the S-OX (oxygen calibration) control so that the display reads 20.9 percent oxygen.

4.6 Calibrate the oxygen sensor by using a calibration cylinder of a known concentration of oxygen in nitrogen. If the instrument does not respond accurately, then adjust the S-OX screw at the base of the instrument until the reading on the instrument corresponds with the concentration printed on the cylinder of calibration gas.

4.7 Record the calibration in the instrument logbook.

5 Operation

5.1 Turn the instrument ON.

5.2 Select desired mode of operation.

5.3 Place instrument in desired monitoring location.

5.4 When fully charged, the battery should operate the sensor for at least 10 hours.

5.5 The alarms were preset at the factory and unless changed will alarm at 20 percent LEL, 10 ppm H_2S, 19.5 percent O_2, and 23.0 percent O_2.

6 Limitations

These instrument specific instructions are to be used in conjunction with H&S Procedure 445 and in accordance with the manufacturers instructions.

INDUSTRIAL
SCIENTIFIC

Model HMX271

Hydrogen Sulfide, Combustible Gas and Oxygen Monitor

Instruction Manual

INDUSTRIAL SCIENTIFIC CORPORATION

355 Steubenville Pike
Oakdale, PA 15071-1093

Call Toll Free: 1-800-DETECTS (338-3287)
U.S.A. and Canada
or
(412) 788-4353

1703-1717

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

1.0 GENERAL INFORMATION

1.1 Air and Gases

Air is a mixture of gases. Clean, dry air consists of 78.08 volume percent nitrogen, 20.95 volume percent oxygen, and 0.87 volume percent other gases including argon and carbon dioxide. Life, combustion and various chemical reactions are supported by oxygen. Human beings can tolerate moderate variations in the amount of oxygen in the air. Breathing becomes labored when the air contains only 16% oxygen. However, U.S. Department of Labor - OSHA (General Industry Safety and Health Standards 29 CFR 1810.94 (d) (vi) requires the use of air-supplied respirators to provide adequate oxygen when the concentration of oxygen is less than 19.5%. Oxygen deficiency can be the result of the displacement of oxygen by other gases, aerobic bacterial activity, combustion, and the oxidation of metal.

A mixture of air and a combustible gas or vapor (hereinafter the term "gas" shall be understood to mean

combustible gases and/or vapors) will support the propagation of a flame away from a source of ignition only when the concentration of the gas, as a percent of the total volume of the mixture, is within the flammable range of that specific gas or combination of gases. An air/gas mixture in which the concentration of gas is below the flammable range will be too lean to propagate combustion. The flammable range has a lower limit and an upper limit; i.e., the lower flammable limit (LFL) and "lower explosive limit" (LEL) are equivalent, as are "upper flammable limit" and "upper explosive limit".

1.2 Warnings and Cautionary Statements

Certain conditions or failure to observe certain necessary procedures will impair the performance of the instrument. These are outlined below to be read and understood by any person using the instrument.

1.2.1 Oxygen deficient atmospheres will cause erroneous low determinations of the combustible gas content of the air.

1.2.2 Oxygen enriched atmospheres will cause erroneous high determinations of the combustible gas content of the air.

1.2.3 Verify the calibration of the combustible detecting mode of the instrument after use where the combustible gas content as a percent of the LEL was 100% or greater. Long continuous use (hours for one test) at high LEL concentrations (50% to 100%) or high humidities (90% to 100% RH) may cause damage to the LEL detector, resulting in reduction of sensitivity and erratic behavior, including inability to calibrate. If this occurs, the LEL detector should be replaced.

1.2.4 Silicone compound vapors and sulfur compound vapors will cause desensitization of the LEL detector and thus cause erroneous low determinations. Verify the calibration of an instrument that has been used where these vapors were present before that instrument is relied upon for accurate measurements. Replace the LEL detector if the instrument cannot be calibrated.

1.2.5 Changes in the total pressure of the atmosphere due to changes in altitude will bear on the instrument's determination of the air's oxygen content. Calibrate the oxygen monitor mode of the HMX271 at the altitude at which it will be used.

1.2.6 Any rapid up-scale reading followed by a declining or erratic reading, or reading greater than 100% LEL, may indicate a gas concentration beyond the accurate response range of the LEL detector. Either take immediate corrective action to eliminate this potential hazard; or, withdraw from it.

1.2.7 Readings that are either negative or greater than 100% LEL may indicate an explosive concentration of combustible gas.

1.2.8 Obstruction of the screened sensor ports will cause erroneous low readings. These screens must be kept clean.

1.2.9 Sudden changes in temperature or pressure may cause temporary fluctuations in the oxygen reading.

2.0 INTRODUCTION

The HMX271 3-Gas Monitor continuously and simultaneously monitors ambient levels of oxygen, hydrogen sulfide, and combustible gases. All three gases are monitored simultaneously; only one is displayed on the instrument's liquid crystal display (LCD). When one of three membrane switches located immediately below the LCD panel is touched, the respective gas readout will appear on the display. A small triangular pointer also appears on the display, just above the switch that was pressed, to indicate which gas is being displayed. The last gas selected will remain on display until a different switch is pressed. The readout for the three gases may be selected in any sequence that the user desires. When the instrument is first turned on it will automatically display the oxygen readout. (See figure 1).

Although only one gas can be displayed at a time, all of the alarm circuits are active and continuously monitoring for unsafe conditions. If any of the gases reaches a preset safety limit, the audible and visual alarms are activated immediately. The audible alarm is a high pitched tone that alternates between two frequencies at the rate of approximately two times per second. A rectangular LCD enunciator appears near the top of the display panel to indicate which gas or gases caused alarm activation. The LCD will continue to display the readout of the gas range last selected by touching one of the membrane switches. (See figure 2).

Combustible gases are displayed in percent of lower explosive limit (LEL) in 1% LEL increments, Hydrogen Sulfide (H_2S) in parts per million (ppm) in 1 ppm increments, and oxygen (OX) in percent by volume in 0.1% increments.

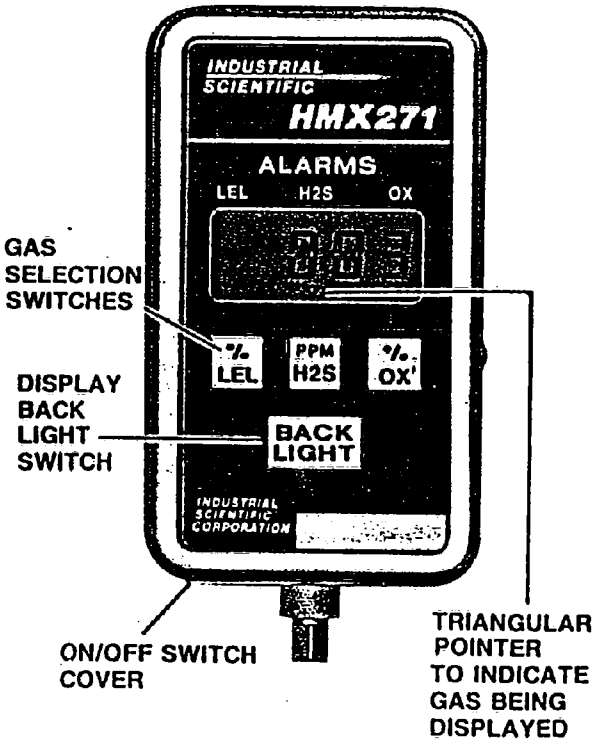


Figure 1.
HMX271 Controls

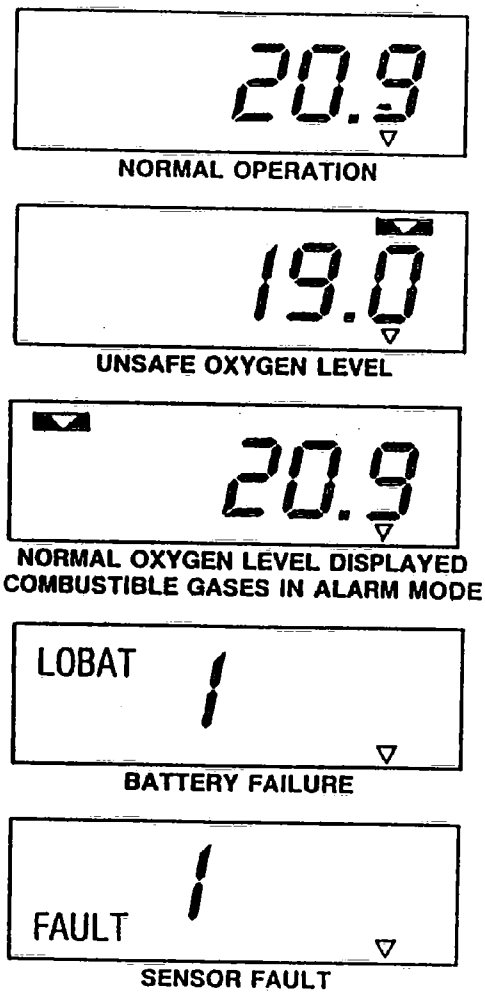


Figure 2.
Display and Alarms

Although primarily intended as a diffusion instrument, the monitor can be equipped for remote monitoring with an optional sampling pump (ISC Model SP200 or SP201).

3.0 UNPACKING

The shipping case should contain the following items. Account for each item.

TABLE I. PACKING LIST

QTY.	PART NO.	DESCRIPTION
1	1810-1139	HMX271 Hydrogen Sulfide, Combustible Gases and Oxygen Monitor
1	1703-1717	Model HMX271 Instruction Manual
1	1810-1204	Single Carrying Case
1	1700-6933	Calibration Cup
1	1700-7592	Tygon Tubing
1	1700-7147	5/64 Allen Wrench
1	1703-1667	Calibration Tool

After unpacking, visually inspect each item for signs of physical damage. If damage is evident, contact either the local distributor of ISC detection instruments, or call Industrial Scientific at:

1-800-DETECTS (338-3287)
U.S.A. and Canada
or
(412) 788-4353

4.0 BATTERY PACK

Before Proceeding to use the Instrument, Charge the Batteries and Calibrate the Measuring Modes

NOTE: Instrument must be turned off before charging.

4.1 Charging the Batteries

The HMX271 requires a constant 75 milliamperes charging current. A completely discharged battery's full potential will be restored by 14 hours of charging. A Single Unit Charger, Part Number 1810-0123, and a Five Unit Charger, Part Number 1810-0115, are available from the local distributor of Industrial Scientific Corporation products. There is no danger of overcharging the batteries when using either of the above ISC 200 Series Constant Current Battery Chargers.

Apparent reductions in battery capacity may result from repetitive use patterns. A fully charged battery that does not deliver energy for at least 10 hours continuous monitoring may have developed a "memory" condition. To eradicate this, entirely discharge (until low battery warning) and then fully recharge the battery. The memory effect can be avoided by using the HMX271 so that the battery is discharged to varying depths.

The HMX271 is powered by a 750 milliamp/hour (mah) rechargeable nickel cadmium battery pack. When charged for 14 hours on any of the ISC charging units, the battery will power the monitor for a minimum of 10 hours. Typical run time will be approximately 12 hours. When the battery nears the end of its useful charge life (approximately ½ hour of operating time remaining), the monitor will start to emit short audible tone bursts to warn of a low battery condition. The tone bursts are two to three minutes apart and about one to five sec-

onds in duration increase in length as the end of battery life approaches. When the battery is no longer capable of supplying sufficient power to the monitor, the monitor will go into the battery failure mode. The battery failure mode is indicated by all of the display digits being blanked except for the numeral (1) in the far left position; the word LOBAT appears in the upper left corner of the display; and the audible alarm sounds a continuous high pitched tone. (See figure 2). The above condition will continue for approximately 10 minutes or until the monitor is switched off. A 14 hour recharging then is needed to restore the battery to a full charge condition.

Note: After the monitor goes into the battery failure mode, it should be switched off within a few minutes. If the unit is not switched off within 10 minutes, inaccurate fluctuating readings will appear on the display and serious battery damage may result.

The HMX271 is also equipped with circuitry that detects LEL sensor faults. If a fault condition should occur, the monitor will go into a failure mode similar to the low battery failure mode and the word FAULT will appear in the lower left corner of the display. When the oxygen sensor is missing, audible and visual alarms are activated. (See figure 2.)

5.0 PREPARING FOR OPERATION

5.1 Switching ON the Instrument (see Figure 3)

To switch on the instrument:

1. Back off the knurled nut that holds the calibration cover in place.

2. Rotate the cover so that the metal button is inserted in the oval-shaped hole.

3. Tighten the nut until the calibration cover is flush with the case. Do not overtighten.

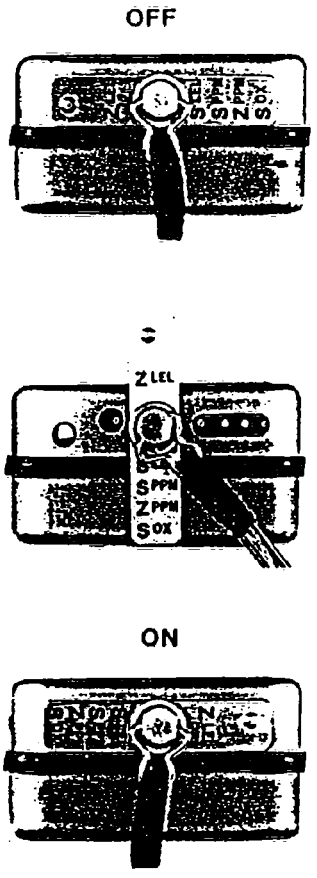


Figure 3.
Instrument ON/OFF

4. The monitor is ready for use as soon as the display stabilizes (approximately 60 seconds).

5.2 Switching OFF the instrument (see Figure 3)

To switch off the instrument:

1. Back off the knurled nut that holds the calibration cover in place.
2. Rotate the cover so that the metal button is inserted in the unmarked round hole.
3. Tighten the nut until the calibration cover is flush with the case. Do not overtighten.

6.0 CALIBRATION

6.1 General Information

Maximum safety will be insured by performing a calibration check on the HMX271 prior to each use. A calibration kit and replacement cylinders of calibration gas are available from ISC (see Table II).

For best calibration accuracy, the monitor should be allowed to stabilize at room temperature for at least one (1) hour before calibration.

TABLE II. CALIBRATION EQUIPMENT

Part No.	Description
1810-1279	Calibration kit, consisting of: Carrying Case Cylinder of Hydrogen Sulfide Cylinder of Pentane and Oxygen Regulator Calibration Cup
1810-0859	Replacement cylinder of Hydrogen Sulfide
1810-1238	Replacement cylinder of Pentane and Oxygen

6.2 Checking Alarm Settings

Before calibrating the instrument, it is good practice to check all of the alarm settings to verify that they are set correctly. The calibration cover must first be released and turned ninety degrees to expose the five calibration adjustments along the bottom end of the instrument. The function of the five control adjustments are: (1) LEL zero offset Z LEL, (2) LEL span sensitivity S LEL, (3) H_2S span sensitivity S PPM, (4) H_2S zero offset Z PPM and (5) OX calibration S OX. (See figure 4).

6.2.1 To Check LEL

To check the LEL alarm setting, switch the display to the LEL mode. Slowly turn the Z LEL (LEL zero offset) adjustment in the clockwise direction until the alarm is activated. When the alarm point is reached, slowly turn the adjustment back and forth through the point at which the alarm is activated. Observe the display. The display will show the percent of LEL at which the alarm is set to activate. Turn the adjustment back to the zero display reading. The factory setting for the LEL alarm is 20%.

6.2.2 To Check H_2S

Checking the H_2S alarm setting is similar to the procedure used for the LEL. Switch the display to the H_2S mode and slowly turn the Z PPM (H_2S zero offset) adjustment in the clockwise direction until the alarm is activated. Slowly turn the adjustment back and forth through the point of activation and observe the display for the ppm level at which the H_2S alarm activates. Turn the adjustment back to the zero display reading. The factory setting for the hydrogen sulfide alarm is 10 ppm.

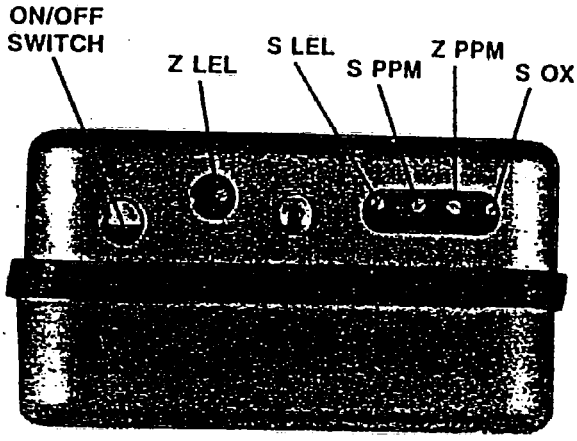


Figure 4.
Calibration Adjustments

6.2.3 To Check OX

Unlike the LEL and H_2S, the OX section does not require a Z adjustment. After switching to the OX mode, observe and note the display reading, which should be 20.9% in normal room air. Slowly turn the S OX (OX calibration) adjustment counterclockwise until the low oxygen alarm setting is reached. Slowly turn the adjustment back and forth through the alarm point to verify the setting. After the low alarm setting is located, slowly turn the adjustment in the clockwise direction until the high oxygen alarm setting is found. Slowly turn the adjustment back and forth through the alarm point to verify the setting. Return the display to the original setting. The oxygen alarms are factory set at 19.5% for the low alarm and 23.0% for the high alarm.

6.3 Adjusting the Alarm Settings

In order to access the four alarm adjustments on the HMX271, the instrument must be opened by separating the two halves of the case.

To open the case:

1. Use the 5/64" Allen wrench to remove the screws on either side of the monitor.

2. Back off the knurled nut of the strap assembly as far as possible. Use a 5/16" wrench to remove the center post of the strap assembly.

3. Lift the case top off the monitor. Set the case top (containing the electronics) aside, being careful not to damage the wires between the case top and bottom.

4. The alarm adjustments are located along the top end of the main printed circuit board and are identified with a label. (See figure 6).

6.3.1 Adjusting the LEL Alarm

Switch the display to the LEL mode and turn the Z LEL (LEL zero offset) adjustment, so that the display shows the desired level of LEL to which the alarm is to be adjusted. If the alarm is activated, the new LEL alarm is higher than the one currently set. Turn the LEL alarm adjustment, in the clockwise direction until the alarm is deactivated. Then, slowly turn the LEL alarm adjustment in the counterclockwise direction until the point is reached that again activates the alarm. The Z LEL adjustment should then be turned slowly back and forth through the alarm trip point to verify that it is correct. Return the display to zero.

6.3.2 Adjusting the H_2S Alarm

The H_2S alarm is set in the same manner as the LEL alarm with the exception of the display mode being switched to H_2S and the use of the Z PPM (H_2S zero offset) and the PPM alarm adjustments. In some instances, where the alarm is to be set very high, it may be necessary to turn the S PPM (H_2S span sensitivity) adjustment clockwise in order to set the desired level on the display. If the S PPM adjustment is moved, the instrument must be recalibrated.

6.3.3 Adjusting the OX Alarm

After the display has been set to the OX mode, use the S OX (OX calibration) control to set the desired level of the low oxygen alarm on the display. If the alarm is activated, the present setting is higher than the desired new setting. Turn the low alarm adjustment, in the counterclockwise direction until the alarm is deactivated. Now, turn the low alarm adjustment slowly clockwise until the alarm is once again activated. Slowly turn the S OX calibration control back and forth through the

alarm point to verify the setting. Adjust the S OX calibration control so that the display reads the desired level for the high oxygen alarm. If the alarm is activated, the current setting is lower than the desired new setting. Turn the high alarm adjustment, in the clockwise direction until the alarm is deactivated. Now, turn the high alarm adjustment slowly in the counterclockwise direction until the alarm is once again activated. Turn the S OX calibration control back and forth through the alarm point to verify the setting. Return the display to its original setting.

Note: It is possible to overlap the high and lower oxygen alarm settings. If this happens, the alarm will be activated for all oxygen levels. To exit this condition, turn the high oxygen alarm to its highest clockwise position and the low oxygen alarm to its lowest counterclockwise position and repeat procedure 6.3.3.

Reassemble the monitor and perform calibration of all three gases.

7.0 ZERO ADJUSTMENTS

Only the H_2S and LEL sections of the HMX271 require zero calibration. (See figure 5). In clean air, switch the display to the H_2S mode and adjust the Z PPM (H_2S zero offset) by turning it counterclockwise until the minus sign (–) appears on the display. Very slowly turn the Z PPM control clockwise until the minus sign just goes off, leaving (000) in the display.

In clean air, switch the display to the LEL mode and adjust the Z LEL (LEL zero offset) control by turning it counterclockwise until the minus sign (–) appears on the display. Very slowly turn the Z LEL control clockwise until the minus sign just goes off, leaving (000) in the display.

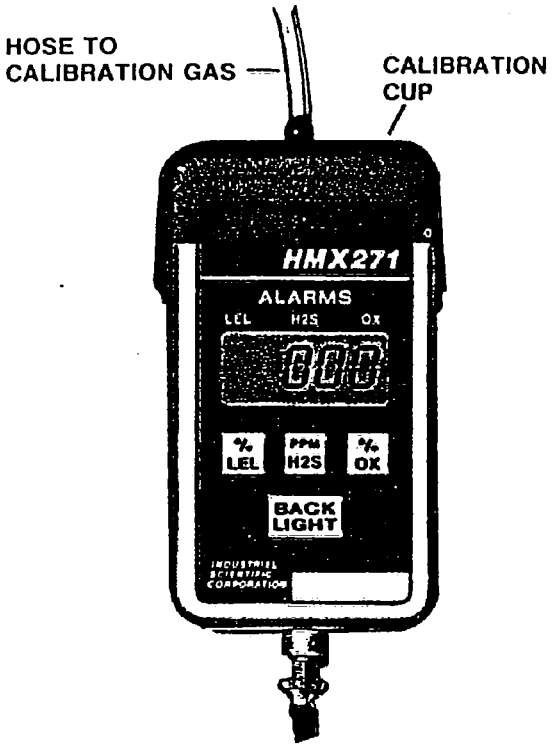


Figure 5.
Calibration Cup

8.0 SPAN ADJUSTMENTS

After the LEL and H_2S zeros have been properly set, the span sensitivity may be calibrated. Switch the display to the LEL mode and apply the LEL span gas to the monitor using the calibration cup. Allow the gas to flow for two (2) minutes. With the gas still flowing, adjust the S LEL (LEL span sensitivity) control, on the bottom of the instrument, so that the display reads the percent of LEL, to the nearest percent, that is printed on the LEL calibration gas cylinder. Remove the LEL calibration gas.

Repeat the above procedure for H_2S using hydrogen sulfide span calibration gas with the S PPM (H_2S span sensitivity) control to complete the span calibration.

In clean air, known to have 20.9% oxygen, the S OX (OX calibration) control should be adjusted so that the display reads 20.9% oxygen. Final calibration of the oxygen readout should only be done in free air if the user is sure that the air contains the normal 20.9% oxygen. The readout should then be adjusted to 20.9. If there is any doubt of the oxygen content of the air, calibration gas of a known percentage of oxygen in nitrogen should be used.

9.0 MAINTENANCE

9.1 Screen Replacement

Specially treated stainless steel screens protect the sensors from direct impact and dust particles.

To remove the screens:

1. Remove the four (4) screws that hold the bezel and screens in place.

2. Forced air cleaning may not remove very fine dust particles clogging the screens. NEVER use any type of solvent to clean the screen, since they may degrade sensor performance. Screens that cannot be cleaned should be replaced. See replacement parts list.

3. Reassemble the screen and bezel to the monitor.

9.2 Battery Pack Replacement

Since it is normal for gas detection sensors and batteries to deteriorate with age, the HMX271 has been designed so that it is possible to replace all of the sensors and the battery using only simple hand tools. No soldering is required. In all cases, it is necessary to separate the two case halves. Always handle the opened instrument carefully to prevent damage to the wiring harness. The top half of the case should be flipped over and allowed to lay face down next to the bottom half of the case.

To replace the battery, first locate the battery wires that lead to a small two (2) terminal connector located at the far left end of the regulator printed circuit (PC) board. (See figure 6). Carefully pull the connector from the PC board and lift the battery from the case. It may be necessary to gently pry the battery free with a small screwdriver or similar object. Install the new battery in reverse order and carefully lay the battery leads down against the regulator PC board before reassembling the case halves.

9.3 Oxygen Sensor Replacement

Replacement of any of the sensors requires that the bezel and screens be removed first. This should be done prior to separating the case halves.

Note: Before replacing any of the sensors, pull the battery connector off to remove power.

To replace the oxygen sensor, first locate the small black connector in the sensor leads and carefully pull the two halves apart. Locate and remove the two long #2 screws that go through the front of the case bottom and into the oxygen sensor retaining bracket. Lift the oxygen sensor and bracket out of the instrument. When the sensor is removed, the plastic mounting ring may adhere to the sensor surface. The ring should be reinstalled in its original position. Next, install the new sensor in reverse order and reassemble the instrument.

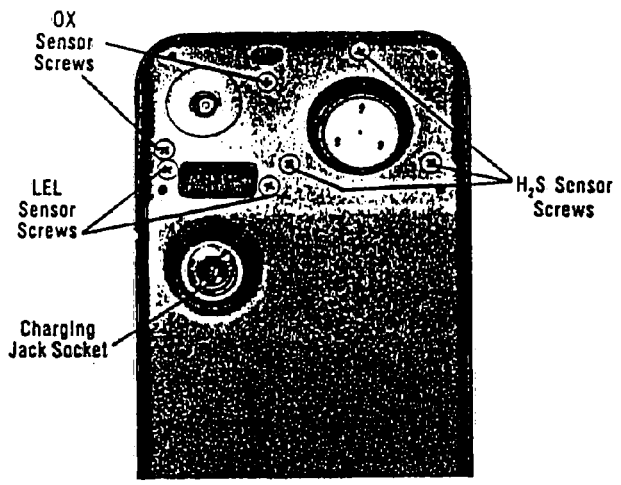
Note: It is normal for the instrument to go into the high oxygen alarm immediately after a new oxygen sensor is installed. After the new sensor is connected to the instrument, it takes approximately ten minutes for the sensor to stabilize.

9.4 Hydrogen Sulfide Sensor Replacement

In order to replace the hydrogen sulfide sensor, the oxygen sensor must be removed first. After the oxygen sensor has been removed, locate the three long #2 screws that extend through the instrument case bottom and into the threaded inserts on the sensor PC board. Lift the PC board, with the sensor attached, from the instrument case bottom. The sensor is connected to the PC board by small pins that are inserted into sockets on the board. Remove the sensor by pulling it free of the sockets. The new sensor will have a small wire that shorts two of the terminals. Remove this wire and insert the new sensor into the sensor PC board. Reassemble the instrument in reverse order.

9.5 Combustible Gas Sensor Replacement

To replace the LEL sensor, it is first necessary to remove the oxygen sensor. After the oxygen sensor is removed, locate the three circuit connector that connects the LEL sensor to the regulator PC board and disconnect it. (See figure 6). Locate and remove the two screws that mount the LEL sensor to the case bottom. Carefully remove the sensor from the case bottom. Install the new sensor in the reverse order. Make certain that the sealing gaskets are properly installed, when mounting the new sensor. Reassemble the instrument in reverse order.



Back view with Bezel and Screens removed

Figure 6.

(Continued on fold-out page)

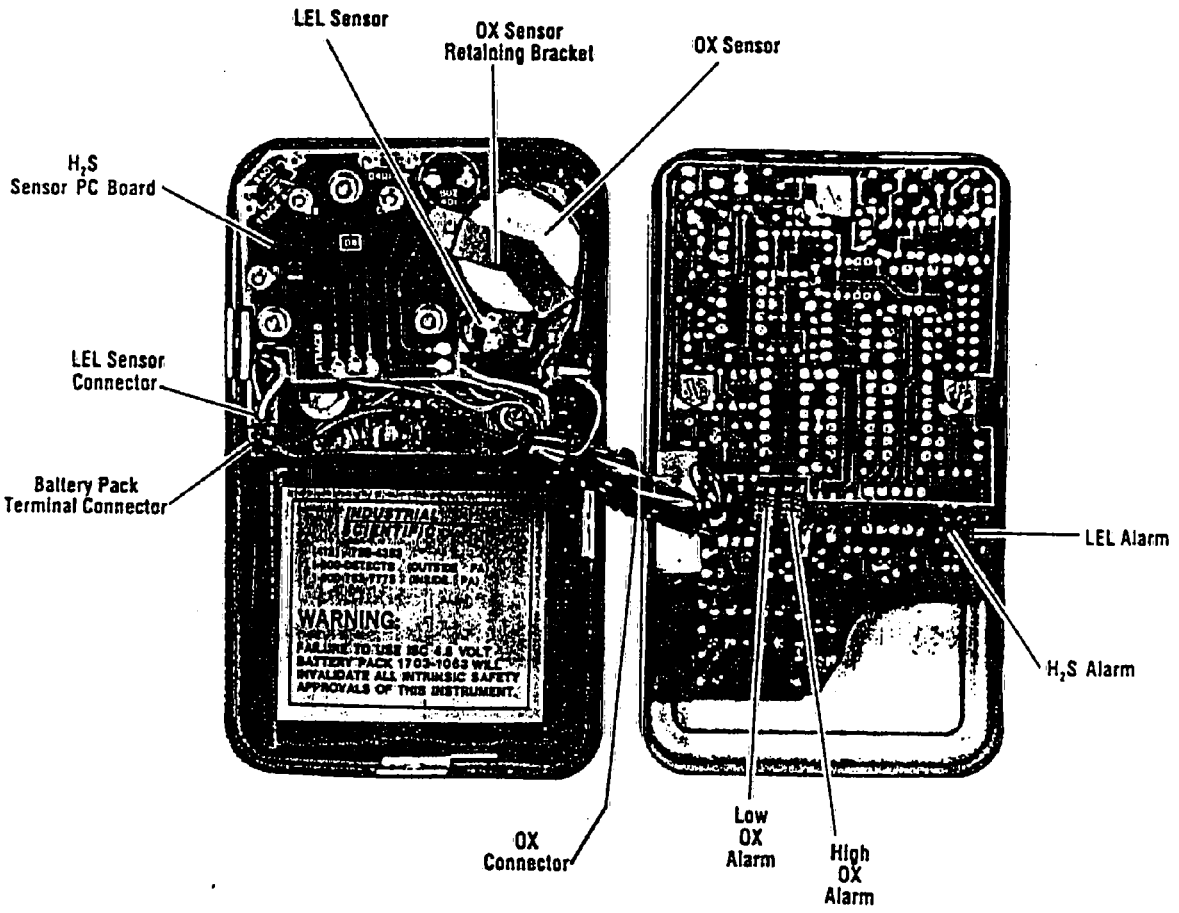


Figure 6.
Battery Pack and Sensor Replacement

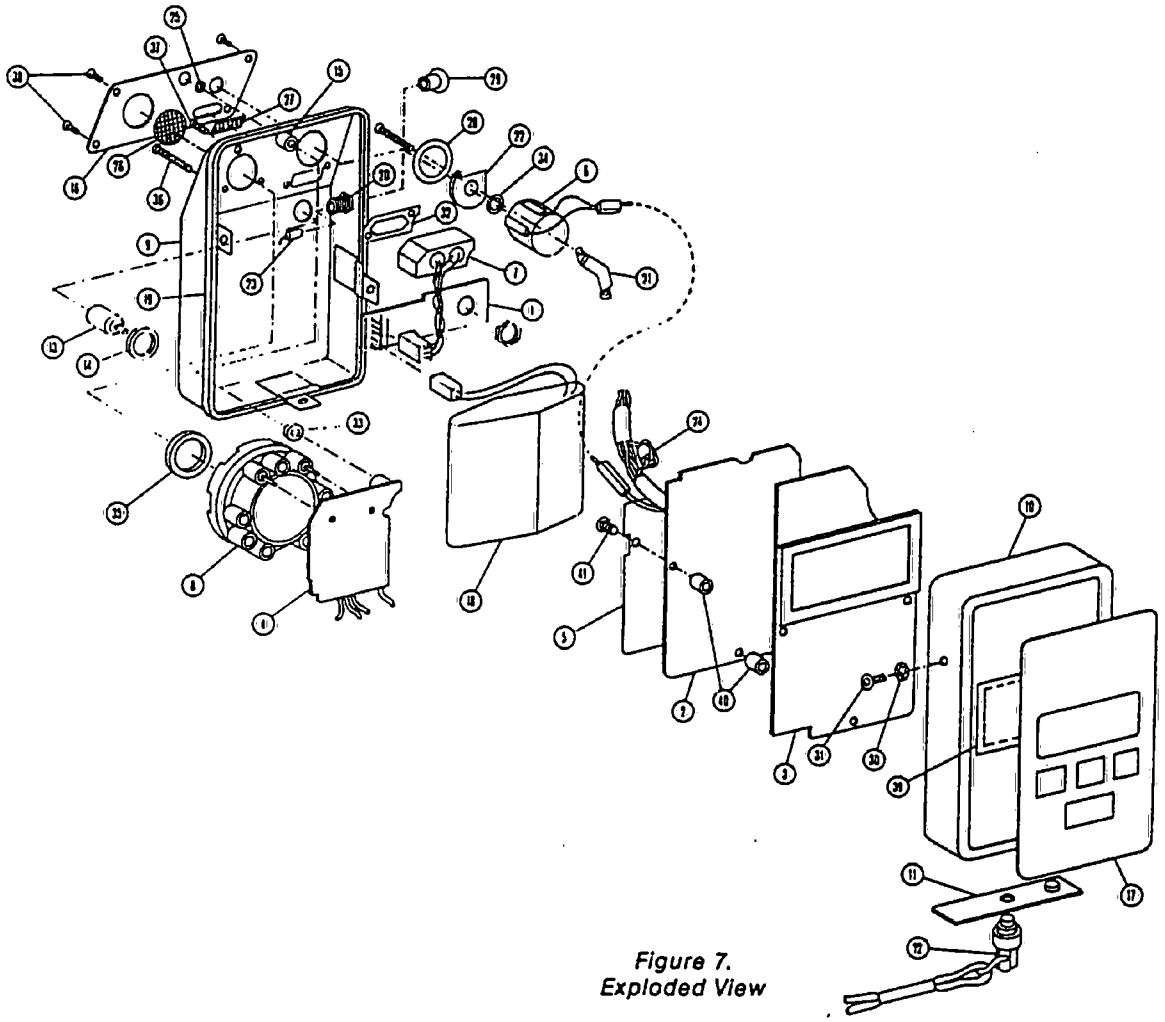


Figure 7.
Exploded View

10. REPLACEMENT PARTS LIST

Item numbers refer to Figure 7, Exploded View.

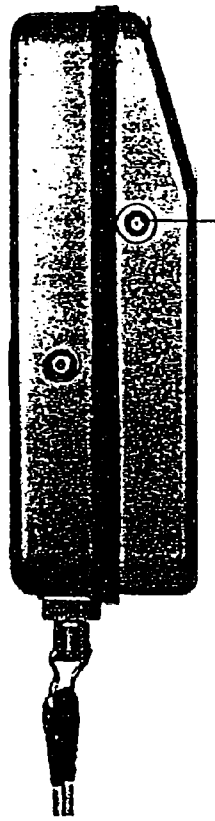
TABLE III. REPLACEMENT PARTS

Item	Part No.	Description
1	1703-1204	Regulator PC Board Assembly
2	1702-9117	Main PC Board Assembly
3	1702-9018	Display PC Board Assembly
4	1702-8762	Sensor PC Board Assembly
5	1703-1444	Insulator Assembly
6	1703-1055	Oxygen Sensor
7	1703-1287	Combustible Detector
8	1702-2062	Hydrogen Sulfide Sensor
9	1702-8614	Case Bottom Assembly
10	1703-0081	Case Top Assembly
11	1703-1600	Calibration Cover Assembly
12	1700-4078	Instrument Strap
13	1700-1660	Charging Jack Socket
14	1702-8630	Charging Jack Bushing
15	1703-0644	Buzzer Adapter
16	1702-8648	Bezel, 3-Gas
17	1702-9091	Faceplate HMX271
18	1703-1063	Battery Pack Assembly
19	1703-1782	Gasket
20	1702-8374	Receptacle
21	1703-1238	Oxygen Sensor Clamp
22	1703-2467	Oxygen Sensor Cap
23	1703-1527	Ferrite Bead
24	1703-1535	Ferrite Bead
25	1703-0669	Buzzer Screen
26	1703-0636	Hydrogen Sulfide Sensor Screen
27	1703-1345	LEL Detector Screen
28	1703-2475	Tape, Transfer
29	1702-9273	Hole Plug
30	1701-9787	Washer, LKG, #6
31	1701-3558	Screw, 6-32 x 3/16
32	1703-1329	Gasket (part of item 7)
33	1703-0651	Seal (part of item 4)

34	1703-0610	Oxygen Sensor Seal
35	1703-1303	Hydrogen Sulfide Sensor Gasket
36	1702-8457	Screw, 2-56 x 1.00
37	1703-0693	Screw, 2-56 x .25
38	1701-7914	Screw, 2-56 x .12
39	1703-1618	RF Screen
40	1703-1089	Spacer
41	1703-1774	Screw, 4-40 x .25

For your convenience and protection, record the serial number of your HMX271 Monitor in the space provided.

Serial No. _____



For those instances where a high noise environment is encountered, a jack is provided on the side of the HMX271 case for use with the remote audible/visual alarm.

Figure 8.
Side View

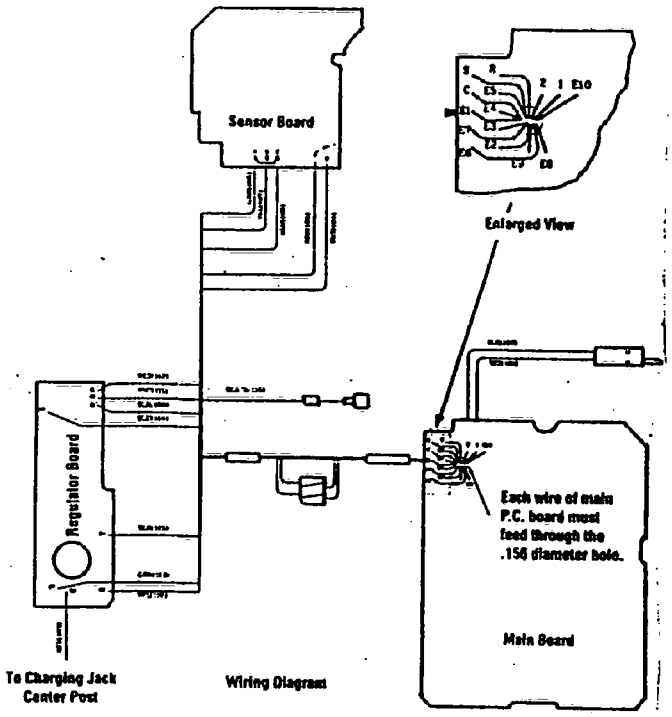


Figure 9.
Wiring Diagram

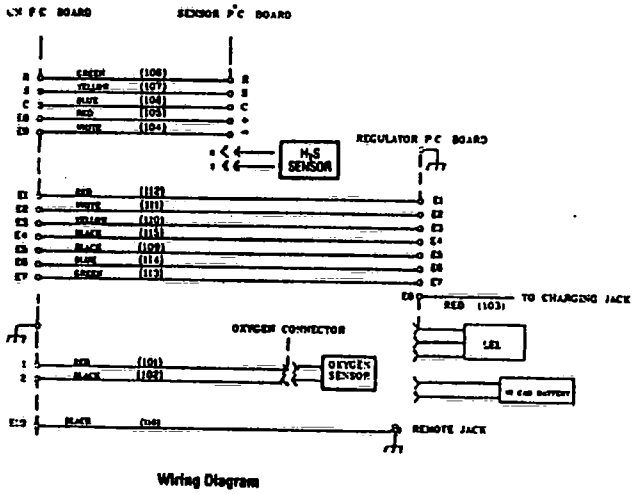


Figure 9.
Wiring Diagram

11.0 SPECIFICATIONS

11.1 Physical and Components

Case:	Stainless steel, dust tight, splash resistant
Dimensions:	4.75 x 2.75 x 1.5 inches (121 x 70 x 38 mm)
Weight:	22 ounces
Sensors:	Hydrogen Sulfide — Electrochemical
	Combustible Gases — Catalytic, Diffusion Type
	Oxygen — Electrochemical
Power Source:	750 mA hour rechargeable, nickel cadmium battery pack
Battery Life:	Minimum 10 hours per battery charge
Readout:	Digital liquid crystal display
Alarms:	Pulsing visual and audible alarms. Continuous visual and audible low battery alarms accompanied by display blanking. Expiring batteries indicated by a unique audible warning signal. Audible and visual alarms are activated when the oxygen sensor is missing. When the combustible gas sensor is open or missing, the fault condition will occur, and the audible alarm will sound a continuous tone.

11.2 Performance

Measuring Range:	Hydrogen Sulfide — 0 to 1999 parts per million (ppm)
	Combustible Gases — 0 to 99% LEL
	Oxygen — 0 to 30% of volume

11.3 Environmental Factors

Temperature Range: −15°C to +45°C

Humidity Range: 0-95% RH (Noncondensing)

APPENDIX
F

APPENDIX F

Health and Safety Operating Procedures #505

General Safety Rules for Work on Hazardous Work Sites

General Safety Rules for Work on Hazardous Waste Sites

PURPOSE

This procedure describes general precautions to be taken and good practices to be followed when performing tasks on a hazardous waste site.

REFERENCES

Standard Operating Safety Guides, November 1984

Occupational Safety and Health Guidance Manual For Hazardous Waste Site Activities

EQUIPMENT

None

FORMS

None

RESPONSIBILITIES

Department Manager, Site Supervisors, and the Health and Safety Department have responsibilities to implement this procedure as listed below.

Department Manager:

1. Assign only technically qualified personnel to perform a task.
2. Provide training and supervision such that the employee demonstrates adequate qualifications.
3. Where applicable, provide adequate personal protective and safety back-up equipment for employee activities.
4. Conduct periodic audits to determine if the applicable health and safety procedures are being followed.

Project Manager:

1. Provide appropriate H&S precautions for project use in accordance with H&S Procedure 301.
2. Contact the H&S Department in the event that field conditions change such that additional requirements may be necessary.

Site Supervisor:

1. Implement project H&S requirements in accordance with this procedure and other applicable procedures, including but not limited to a site-specific health and safety plan.

2. Provide documented project-specific training sessions. These training sessions should include a review of the requirements of this procedure with all field employees involved in the project.

Health and Safety Department:

1. Upon request, prepare a site-specific health and safety plan to incorporate the elements of this procedure.

2. Update this procedure periodically to include current industry practices to minimize the potential for exposure to hazardous environments.

DISCUSSION

All personnel who, by training and certification, are authorized to enter and work within exclusion and/or contaminant reduction zones on hazardous waste sites shall refere to and become thoroughly familiar with the following general hazardous waste site safety rules.

PROCEDURE

Perform the items listed below.

1. Good practices for personal hygiene serve to minimize exposures to hazardous chemicals.

   1.1 Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated or potentially contaminated.

   1.2 Hands and face must be thoroughly washed upon leaving the work area.

   1.3 Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

1.4 No facial hair that interfers with a satisfactory fit of the mask-to-face-seal is allowed on personnel required to wear respirators.

1.5 Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, or discolored surfaces; kneel on ground; or lean, sit, or place equipment on drums, containers, or the ground.

1.6 Medicine and alcohol can enhance the effects from exposure to toxic chemicals. Therefore:

- o prescribed drugs should not be taken by personnel on high hazard operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician; and
- o alcoholic beverage intake should be minimized or avoided during time off from field operations.

NOTE: The consumption of alcohol is strictly prohibited at any time at a field job site. Violation of this requirement is grounds for termination.

2. Standard practices shall be implemented during site operations in order to minimize the potential for personnel exposure to hazardous chemicals.

2.1 All personnel must comply with established safety procedures; any worker who does not comply with safety policy, as established by the Project Health and Safety Officer, will be immediately dismissed from the site.

2.2 All personnel going on-site must be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.

2.3 Personnel and equipment in the contaminated area should be minimized, consistent with effective site operations.

2.4 Personnel on-site must use the buddy system when wearing respiratory protective equipment. As a minimum, a third person, suitably equipped as a safety backup, is required during initial entries.

2.5 Visual contact must be maintained between pairs on-site and safety personnel. Entry team members should remain close together to assist each other during emergencies.

2.6 Wind indicators visible to all personnel should be strategically located throughout the site.

2.7 Personnel should practice new or unfamiliar tasks prior to starting the actual procedure on-site.

2.8 Work areas for various operational activities must be established.

2.9 Each worker should be aware of all dangerous situations or conditions that may develop from or during work activities, and mentally prepare for emergency response to those hazards.

3. Personal protective equipment may be used to reduce direct contact with the hazardous contaminant.

3.1 Any required respiratory protective devices and clothing must be worn by all personnel going into areas designated for wearing protective equipment.

3.2 Each worker authorized to enter restricted areas of the site while wearing respiratory protection must be fit tested with the models of respirators the individual will wear (brand, style, and size), prior to its use within a restricted zone.

3.3 Disposable clothing should be used whenever possible to minimize the risk of cross-contamination from used safety clothing.

4. An effective decontamination system shall be established in order to prevent the spread of contamination.

   4.1 Procedures for leaving a contaminated area must be planned and implemented prior to going on-site. Work areas and decontamination procedures must be established based on expected site conditions.

   4.2 Work and decontamination procedures (and work areas, if easily reselected), should be established based on prevailing site and weather conditions, which are subject to change.

   4.3 Proper decontamination procedures must be folllowed before leaving the site.

5. A contingency plan shall address the procedure to follow in the event of an accident or an injury.

   5.1 During field operations, on-site workers act as safety backup to each other. Off-site personnel provide backup assistance during emergency response.

   5.2 Entrance and exit locations must be designated and emergency escape routes delineated. Warning signals for site evacuation must be established.

   5.3 Communications using radios, hand signals, signs, or other means must be maintained between initial entry members at all times. Emergency communications should be prearranged in case of radio failure, the necessity for evacuation of site, or other reasons.

   5.4 Any medical emergency supercedes routine safety requirements.

APPENDIX
G

APPENDIX G

Health and Safety Operating Procedure #508

General Safety Rules for Environmental Sampling With the RECON® Multimedia Sampling System

General Safety Rules for Environmental Sampling with the RECON[SM] Multimedia Sampling System

PURPOSE

This procedure describes general precautions to be taken and good practices to be followed when performing environmental sampling using the RECON[SM] Multimedia Sampling System of the soil-gas van. This procedure also specifies the minimum chemical hazard protection protocols required for field activities if site-specific chemical hazards have not been addressed in a more specific project H&S guidance document.

REFERENCES

Occupational Safety and Health Guidance Manual For Hazardous Waste Site Activities

D.O.T. (Department of Transportation) driver safety regulations.

H&S Procedure 121 - Health and Safety Review of New Projects

H&S Procedure 131 - Incident Reporting

H&S Procedure 301 - Minimum Health and Safety Requirements

H&S Procedure 341 - Electrical Safety Practices/Buried Utilities

H&S Procedure 505 - General Safety Rules for Work on Hazardous Waste Sites Documents

Geoprobe System's 8-M Operations Manual

EQUIPMENT

Hard Hat (For Overhead Hazards)	Safety Glasses
Hearing Protection	Steel Toe Shoes
Safety Belt (Vehicle)	Work Gloves
	CPC (as needed)

FORMS

Completed hazardous materials shipping manifest for transport of GC supply compressed gases.

RESPONSIBILITIES

Department Manager, Project Managers, Site Supervisors, the Health and Safety Department and Sampling Technicians have responsibilities to implement this procedure as listed below.

Department Manager:

1. Assign only technically qualified personnel to perform a task.

2. Provide training and supervision such that the employee demonstrates adequate qualifications.

3. Where applicable, provide adequate personal protective and safety back-up equipment for employee activities.

4. Conduct periodic audits to determine if the applicable health and safety procedures are being followed.

5. Refer technical questions concerning H&S issues to the H&S Department.

Project Manager:

1. Consult the H&S Department for project-specific guidance on safety matters for activities on your job sites.

2. Provide appropriate H&S precautions for project use, in accordance with the project-specific H&S Guidance documents that apply.

3. Contact the H&S Department in the event that field conditions change such that additional requirements may be necessary.

4. Provide for subsurface utility clearances for project sites.

Site Supervisor/Senior Sampling Technician:

1. Implement project H&S requirements in accordance with this procedure and other applicable procedures, including but not limited to a site-specific health and safety plan and the client's facility safety program, if provided.

2. Provide and document project-specific training sessions. These training sessions should include a review of the requirements of this procedure with all field employees involved.

3. Verify subsurface utility clearances prior to subsurface penetration with the Geoprobe drive points.

4. Provide for appropriate environmental hazard monitoring and emergency response support for your site activities.

5. Consult the H&S Department, as needed, for support for your field operations.

6. Strictly enforce on-site compliance with this procedure and other applicable site-specific H&S guidelines by persons in your charge.

Health and Safety Department:

1. Upon request, perform a project-specific hazard evaluation. Prepare a site-specific health and safety plan to incorporate the elements of this procedure, if necessary.

2. Provide technical assistance to project personnel implementing this procedure.

3. Update this procedure periodically to include current industry practices to minimize the potential for exposure to hazardous environments.

Sampling Technicians:

1. Perform sampling operations in a safe manner using good judgment at all times. Refrain from any activity that might endanger yourself, fellow workers, or the general public.

2. Report any observed unsafe condition or act in a timely manner.

3. Report changed or unanticipated field conditions before continuing the field operation.

4. Report safety incidents and injuries in accordance with H&S Procedure 131 - Incident Reporting.

5. Report roadway accidents on your field vehicles to your Department Manager.

6. Abide by the H&S requirements set forth in this procedure and other applicable H&S procedures.

7. Consult with your Department Manager when H&S questions arise.

DISCUSSION

Field activities involving the Mathes RECON[SM] Multimedia Sampling System involve a wide range of site conditions and safety hazards. RECON[SM] activities are commonly conducted on chemically impacted sites, some of which are covered under OSHA Hazardous Waste Site Regulations 29 CFR Part 1910.120.

Numerous hazards are associated with field investigation of chemically contaminated sites. Chemical hazards include toxic effects to workers as well as hazards from encounter of flammable liquids or vapors. Hazards from sampling equipment, personnel protection practices, extreme weather conditions, and industrial operations on

a client's active facility can cause physical injuries and thermal stress to workers.

Exposure of workers to chemical products are likely to be from direct dermal contact with free products, or inhalation of organic vapors released during handling of grossly contaminated sampled materials. In general, the chemical contaminants present relatively low inhalation and limited dermal exposure hazards. Sampling technicians are likely to be at greater risk from exposure to ambient levels of contaminants on certain sites than from the chemical hazards generated by their own activities.

Physical hazards to workers include physical injuries from operating RECON℠ sampling equipment, and possibly thermal stress from wearing chemically protective clothing or being exposed to inclement weather, or both. Physical injuries can occur from operation or failure of RECON system equipment hydraulics, handling of pressurized gas supply cylinders for the on-board analytical GC, and any manual labor needed to support the field operation. However, the greatest potential physical hazard will be accidental penetration into pressurized chemical process piping or other "Live" buried utilities with the hydraulic-driven sampling probes.

In general, the nature of the RECON℠ equipment and sampling procedures tends to limit most potential hazards for sampling/analytical technicians because:

- the equipment is relatively small and lightweight;
- quantities of chemically contaminated materials handled is small; and
- subsequent chemical exposure of personnel is minimal

However, site-specific chemical hazards and project-specific H&S requirements must be evaluated on a case-by-case basis.

PROCEDURE

Implement the following procedure:

1. Sampling technicians operating the RECON℠ system equipment must be adequately trained for the projects they are assigned to.

   1.1 Sampling personnel must meet the minimum training prequalification requirements for

project field personnel performing activities on the subject job site.

1.2 Sampling personnel must be provided the site-specific training required for their tasks on site. This training will be performed and documented by Mathes safety management representative assigned this responsibility for the project. This training may be provided by:

- the Project Safety Officer;
- the Site Safety Officer (if a large Mathes operation);
- the Site Supervisor, if also acting as the Site Safety Officer; or
- the senior technician of the RECON℠ sampling team.

NOTE: The senior sampling technician is the task leader and on-site safety representative for the RECON℠ sampling field team. If no other on-site Mathes Manager has direct line authority over the RECON℠ sampling activities, the senior sampling technician must also assume roles and responsibilities of the Site Supervisor/Acting Site Safety Officer for the RECON℠ field operation.

1.3 As a minimum, the sampling technicians will be provided a site safety orientation to discuss project safety organization, applicable guidance documents, site-specific hazards, topical safety protocols, and emergency preparedness measures.

1.4 The Project Manager must specify the project-specific training requirements for sampling technicians.

2. Sampling technicians must be medically qualified for the projects they are assigned to.

2.1 Sampling personnel must meet the medical certification requirements for project field personnel performing activities on the subject job site.

2.2 Medical certification requirements may include:

- fitness to wear a respirator;
- active participation in Mathes' medical surveillance program for hazardous waste site work; and
- site-specific medical screening or monitoring.

2.3 The Project Manager must specify the project-specific medical qualification/ monitoring requirements for sampling technicians.

3. Access to the work zone should be restricted to authorized personnel only.

3.1 Access to the immediate vicinity of RECON℠ system sampling activities will be limited to only those project personnel, including subcontractors, who have reason to be in the area. Mathes will not attempt to enforce access restrictions, but will summon facility security personnel, if available, or local law enforcement officers immediately. Mathes will not assume any responsibility for the activities or safety of intruders into our work zone.

3.2 Access into known (or suspected) chemical hazard areas by Mathes personnel will be limited to personnel meeting OSHA requirements for training, medical monitoring, and respirator fit test.

3.3 Non-Mathes personnel shall be cautioned against entry into a Mathes work zone judged to be a chemical hazard area. If they intrude despite the caution, shut down the operation and summon security.

4. The following minimum safety equipment shall be provided in the RECON℠ system vehicle:

- five pound, ABC rated fire extinguisher;
- emergency eyewash (potable water, minimum);

Note: may use existing eyewash of client's facility);

- first aid kit; and
- pre-packaged, moistened sanitizing "wet" wipes, such as baby wipes (minimum on-site

wash capability, for use following removal of splash protection clothing, or for emergency use for dermal exposure to free chemical product).

5. Chemically protective clothing (CPC) shall be selected and worn according to the nature of physical and chemical hazards of the work being performed, and the requirements specified in project-specific safety guidance documents.

5.1 Sampling technicians shall wear the CPC specified in the site-specific H&S plan (or the client's written facility plan) if provided.

5.2 If no site-specific H&S plan is provided, sampling technicians shall wear the CPC specified in the Mathes H&S operating procedure for handling the project contaminant of concern, if such an SOP exists.

5.3 If no site or contaminant-specific H&S protocols are provided, the CPC listed below will be worn during work activities.

- hard hats (for overhead hazards);
- hearing protection;
- safety glasses;
- steel-toed safety footwear;
- field clothes or work uniform; and
- work gloves with surgical gloves (minimum) for some chemical exposure protection.

NOTE: Additional dermal protection will be required when chemical hazards are present from site contaminants, and direct dermal contact is likely or unavoidable. Specific CPC required is based on the extent of site contamination and field conditions of the site or sample material handled (dry or wet).

When handling contaminated sample material or sampling equipment, also wear:

- impermeable (neoprene or nitrile) outer gloves.

When working in a location known to be (or visibly) surface-contaminated, and conditions are dry, also wear:

- dust goggles (if windy and dusty);
- Tyvek coveralls; and
- rubber outer boots.

Splash protection is required when activities involve handling of visibly contaminated groundwater, or soil saturated with free chemical product. Splash protection is also required during decontamination of equipment contaminated by these same materials. When splash protection is appropriate, also wear:

- chemical splash-proof goggles; and
- polyethylene (poly)-coated Tyvek coveralls.

5.4 Protective and personal clothing shall be changed daily.

6. Respiratory protection will be worn by sampling technicians when required by project-specific safety guidance documents, or when a respiratory hazard is detected or suspected.

6.1 Respirators will be worn as specified in site-specific safety protocols, in priority of:

- the site H&S plan;
- interim guidelines developed by the H&S Department for the project;
- Mathes' H&S operating procedure for the contaminant(s) of concern; or
- the client's facility-specific H&S plan.

6.2 If no guidelines are provided and sampling technicians observe or suspect that site contaminants are present that may require worker chemical protection, including possibly a respirator, further H&S review and guidance is required. When site contaminants are suspected or known to exceed one-half the threshold limit value (TLV), consult the H&S Department for further assistance.

6.3 The Project Manager must consult the H&S Department for a project-specific review of site hazards in order to establish appropriate

protocols for protection of field personnel from respiratory hazards. The results of the review and project-required respiratory protection shall be communicated to Mathes site management personnel.

6.4 The results of the H&S review should also be communicated to field personnel when a respiratory hazard is not anticipated.

6.5 If site conditions warrant wearing a respirator, sampling technicians must be medically prequalified for, and trained in the use of, the respirator to be worn. They must also successfully demonstrate a documented fit test for the respirator to be worn, using stannic chloride irritant smoke (MSA part number 5645, or equivalent) as the challenging agent.

6.6 Sampling personal shall contact the Project Manager or H&S Department if site conditions are perceived to be changed or different than that anticipated so as to pose a potential respiratory hazard.

6.7 Field personnel may temporarily halt work activities for health and safety re-evaluation if they believe that they are at undue risk due to changed or unknown conditions.

7. Air monitoring shall be performed, as required or prudent, to verify that worker exposures to site respiratory hazards are within TLV (or other acceptable occupational exposure) guidelines.

7.1 Air monitoring of sampling technicians will be in accordance with project-specified protocols, as established by the H&S Department during the site hazard review process.

7.2 Use of air monitoring instrumentation for health and safety purposes is limited to personnel trained and qualified in the use of the equipment.

7.3 Use, calibration, and maintenance of air monitoring instruments shall be in accordance with Mathes Health and Safety Operating Procedures 441, 442, and 445, and the manufacturer's manual for the special instrument.

7.4 In general, sampling activities with the RECON[SM] system are not anticipated to generate sufficient contaminant emissions to pose a significant inhalation hazard to sampling personnel. For

this reason, most RECON℠ sampling tasks will not require air monitoring. However, if unanticipated ambient odors should become unexpectedly strong or irritating, halt operations and contact the Project Manager or H&S Department for directions on how to proceed.

7.5 "Rotten egg" odor detection of hydrogen sulfide (H_2S) gas during sampling will require suspension of further sampling activities at that location until either H_2S emission monitoring is implemented or supplied-air protection is provided. Detection of 10 ppm or greater H_2S with an H_2S monitor will require supplied-air respiratory protection.

7.6 If a pressurized release of vapor (from the RECON℠ system-installed probe) is detected, irrespective of the response of on-site air monitoring instruments, shut down the equipment and evacuate the work zone immediately. Unless encounter with methane gas was anticipated and an combustible gas indicated (CGI) has been provided for such a situation, Do not re-enter the work zone until you have contacted the Project Manager or H&S Department.

8. Sampling personnel shall perform field operations with the recon℠ system equipment in a prudent and safety-conscious manner. Sampling technicians must pay special attention to potential hazards from buried utilities, site chemical contaminants, and the sampling equipment itself.

8.1 Buried Utility Hazards

Each sampling location shall be inspected and approved as safe for subsurface penetration with the sampling probe. The inspection will be for buried utility pipes, wires, conduits, tanks or other potentially dangerous structures, overhead powerlines, stability of soil, and other obstructions.

It is always best to obtain clearance for underground utilities and other obstructions from site owners or public utility representatives. In Illinois, call J.U.L.I.E., (800) 892-0123. In Missouri, call Dig-Rite, (800) 344-7483. Some other states and major cities have similar underground utility location clearance hotlines. Call them, or the local utility companies to get drilling locations cleared. Refer to H&S Procedure 341 - Electrical Safety Practices/Buried Utilities for some guidelines on

locating buried utilities and how to proceed with intrusive work.

When driving sampling probes near suspected electrical hazards, the rig should be grounded with a ground wire attached to a ground rod.

8.2 Site Contaminants

Site contaminants and potential safety hazards associated with encounter with these contaminants during sampling activities have been addressed by the project H&S review. The results of this review is the basis for the personal protective measures specified in project-specific safety guidance documents or provided, by default, in this SOP.

In addition, refer to Attachment 1 to this procedure for some recommended safety procedures specific to sampling activities. Also,, refer to H&S Procedure 505 - General Safety Rules For Work on Hazardous Waste Sites.

8.3 Recon[SM] Multimedia Sampling System Equipment Hazards

Use of mechanized, highly technical equipment, such as the RECON[SM] system, poses numerous predominantly physical hazards to sampling personnel. Sampling technicians must follow the specific operation and maintenance procedures provided in the equipment manufacturer's manual. In addition, the specific safety precautions from the manufacturer's manual are provided for ready reference in Attachment 2 to this procedure.

9. Exposure to extreme temperatures could pose a health hazard to sampling personnel. Although not usually a significant hazard unless manual labor is involved, ill effects and injury can result from improper worker protection for thermal stress. Heat and cold stress are best addressed by preventative measure, in particular worker monitoring for signs and symptoms of physical stress.

9.1 Specific procedures for monitoring and minimizing the effects heat stress and cold stress are provided in H&S Procedures 431 and 433, respectively.

9.2 The most effective way to minimize heat stress is to be in good physical condition, take "cool-down" rest breaks when needed to prevent severe overheating, and replace lost body fluids

and electrolytes with plenty of chilled (not ice-cold) water or preferably a commercial "Body Thirst Quencher" such as Gatorade℠, Quik Kick℠ or Squencher℠.

9.3 The most effective way to minimize cold stress is to wear adequate clothing and take "warm-up" breaks in a heated enclosure.

10. Employees shall remove personal protective equipment and remove residual contamination before leaving the job site. Decontamination protocols specified in project-specific safety guidance documents must be followed.

10.1 If personal protective equipment was worn, worker decontamination will consist of the following:

- removal, bagging, and on-site disposal of spent protective clothing, including respirator cartridges;
- washing exposed skin on site following the removal of protective clothing worn for splash protection; and
- standard worker hygiene, including a recommended shower following the completion of the day's activities, especially if protective clothing was worn for splash protection.

10.2 In general, decontamination of RECON℠ system sampling equipment should be minimal unless specifically required by the project work plan. However, equipment decontamination is required prior to demobilization from the work site for any equipment visibly contaminated by chemical product/ wastes. Detergent and water should remove most contaminants encountered.

11. Employees responding to an emergency situation should use the following guidelines.

11.1 Mathes' senior on-site Manager will act as the Site Safety Officer to coordinate responses to on-site physical and chemical injuries or exposures. This responsibility may fall to the senior sampling technician if no other Mathes personnel are on site.

11.2 Sampling personnel should review the site emergency plan and be prepared to respond to an emergency situation by using basic first aid techniques, and initiating, as necessary, the

local emergency medical services (EMS) system. An EMS ambulance will be summoned, if needed.

11.3 Ill effects or injuries resulting from thermal stress to workers will be handled as a physical injury. Refer to H&S Procedure 431 and 433 for first aid procedures for heat and cold stress, respectively.

11.4 In the event of an overexposure or injury involving chemicals, move the victim from the immediate vicinity of the accident/exposure. Affected area(s) will be flushed with water, as needed. An EMS ambulance will be summoned.

11.5 The nearest working phone must be located to provide an emergency communication link to local medical emergency responders and project management. The exact location and specific directions to that phone will be communicated to on-site personnel in their site safety orientation.

11.6 Local emergency response contacts must be identified by the acting Site Safety Officer prior to on-site activities, and shall be communicated to on-site personnel.

11.7 This same information shall be posted in site facilities and/or vehicles, as appropriate.

Posted emergency contacts should include the local:

- ambulance service;
- hospital;
- poison control center;
- fire department; and
- police department.

11.8 Specific directions (preferably a detailed map) to the hospital should be provided. It is advisable to travel the route to the hospital prior to an emergency to verify the accuracy of the route.

11.9 Should an emergency or near-emergency incident occur on-site, report the incident in accordance with H&S Procedure 131.

EXCEPTIONS None.

END OF H&S PROCEDURE 508

ATTACHMENT 1

SAMPLING SAFETY PROCEDURES

Safety practices for sampling activities, in general provide worker protection from chemical hazards associated with the sample materials and preservatives and sample decontamination chemicals. Required chemical protection will be specified in the Site Specific Health and Safety Plan or the applicable H&S Operating Procedure. In addition, the following points of good field practice should be implemented:

- use specified sampling techniques;
- exercise judgment in collecting and handling samples (if the sampling site is not accessible or your method is unfeasible, do not attempt to take a sample. Confer with project management about an alternate sampling site.);
- wipe off spills, dirt and residue immediately;
- immediately repair or replace any damaged gear or equipment;
- if you experience any physical discomfort, abnormalities, or lightheadedness -- stop work, tell the Site Safety Officer/Manager, and move from the immediate work area;
- avoid unnecessary physical contact with sample material;
- perform exposure/environmental monitoring required by Safety Plan;
- avoid contact with chemicals used for sample preservation or decontamination of sampling equipment;
- follow Safety Plan requirements when handling, processing, or packaging hazardous samples; and
- follow packaging, labeling, and shipping requirements of the Department of Transportation and others.

ATTACHMENT 2

GEOPROBE MODEL 8-M

OPERATION SAFETY PRECAUTIONS
(EXCERPTED FROM THE MANUFACTURER'S OPERATIONS MANUAL)

General Precautions

1. Always take vehicle out of gear and set emergency brake before engaging remote ignition.

CAUTION: 2. If vehicle is parked on a loose or soft surface, do not fully raise rear of vehicle with probe foot, as vehicle may fall or move, causing injury.

3. Always EXTEND the probe unit out from the vehicle and deploy the FOOT to clear vehicle roof line before folding the probe unit out.

4. Operators should wear OSHA approved steel-toed shoes and keep feet clear of probe FOOT.

CAUTION: 5. One person only should operate the probe machine and the assembly - disassembly of probe rods and accessories.

6. Never place hands on top of a rod while it is under the machine.

7. Turn off the hydraulic system while changing rods, inserting the hammer anvil, or attaching accessories.

8. Operator must stand to the control side of the probe machine, clear of probe foot and mast, while operating controls.

9. Wear safety glasses at all times during the operation of this machine.

10. Never exert down pressure on the probe rod so as to lift the machine base over six inches off the ground.

CAUTION: 11. Never exert down pressure on a probe rod so as to lift the rear tires of the vehicle off the ground.

12. Always remove the hammer anvil or other tool from the machine before folding the machine to the horizontal position.

CAUTION: 13. The vehicle catalytic converter is hot and may present a fire hazard when operating over dry grass or combustibles.

14. Geoprobe operators must wear ear protection. OSHA approved ear protection for sound levels exceeding 85 dba is recommended.

ATTACHMENT 2, Continued

GEOPROBE MODEL 8-M

OPERATION SAFETY PRECAUTIONS

15. The location of buried or underground utilities and services must be known before starting to drill or probe.

16. Shut down the hydraulic system and stop the vehicle engine before attempting to clean or service the equipment.

CAUTION: 17. Accidental engagement of this machine may cause injury.

Precautions For Operation of Electrical And Hydraulic Controls

1. It is necessary to be familiar with the Geoprobe Machine's controls before operating the machine.

CAUTION: 2. Never operate controls without proper training.

CAUTION: 3. Be sure vehicle is in park before using the remote ignition.

CAUTION: 4. Periodically, check the hydraulic hoses for leaks.

CAUTION: 5. Check the hydraulic fluid reservoir level at the beginning of each operating day.

CAUTION: 6. Check the oil cooling fan each day and make sure that it is operating properly.

CAUTION: 7. This machine vibrates. Tighten hydraulic fittings at least monthly.

CAUTION: 8. The hydraulic oil should be changed after the first 250 hours of service and after every 1000 hours of operation or one year of service thereafter.

9. It is a good habit to keep the electrical switch (3 position) in the off position when starting the engine using the remote ignition.

10. IMPORTANT: ALWAYS SHUT OFF ELECTRICAL SWITCH (DEACTIVATE HYDRAULICS) WHEN NOT USING THE HYDRAULIC CONTROLS.

ATTACHMENT 2, Continued

GEOPROBE MODEL 8-M

OPERATION SAFETY PRECAUTIONS

Precautions For Positioning Geoprobe

CAUTION: 1. Be sure to set the parking brake.

CAUTION: 2. Put engine in park and shut off engine.

CAUTION: 3. Check hydraulic hoses to see if they are free to move.

CAUTION: 4. Check hydraulic fluid level.

CAUTION: 5. Always set the vehicle park brake before you begin probing.

6. IMPORTANT: CHECK FOR CLEARANCE AT ROOF OF VEHICLE BEFORE FOLDING THE GEOPROBE OUT OF THE CARRIER VEHICLE.

7. IMPORTANT: KEEP REAR VEHICLE WHEELS ON THE GROUND SURFACE WHEN PUTTING THE WEIGHT ON THE PROBE UNIT. OTHERWISE, VEHICLE MAY SHIFT WHEN PROBING BEGINS.

Precautions For Drilling Through Surface Pavements

CAUTION: 1. Open Hammer Control Valve before drilling surface pavements.

CAUTION: 2. Keep the Hammer Lever fully depressed during the entire operation.

CAUTION: 3. Wear proper ear protection.

CAUTION: 4. Wear safety glasses.

CAUTION: 5. Wear steel-toed shoes.

6. IMPORTANT: WEAR PROPER EAR AND EYE PROTECTION BEFORE DRILLING SURFACE PAVEMENTS.

7. IMPORTANT: BE SURE TO SHUT OFF THE ROTARY ACTION BEFORE DRIVING PROBE RODS.

Precautions For Probing Operation

CAUTION: 1. Always set vehicle parking brake before beginning probing operations.

ATTACHMENT 2, Continued

GEOPROBE MODEL 8-M

OPERATION SAFETY PRECAUTIONS

CAUTION: 2. Never allow derrick foot to be lifted more than 6" off of ground surface.

CAUTION: 3. Keep probe rod parallel to probe cylinder.

CAUTION: 4. Keep rods threaded tightly together while using percussion.

CAUTION: 5. Wear steel-toed shoes.

CAUTION: 6. Wear eye protection.

CAUTION: 7. Wear safety glasses.

CAUTION: 8. Wear gloves.

CAUTION: 9. Always deactivate hydraulics when adding or removing probe rods, anvils, or any tool in the hammer.

Pertaining To Static Force:

10. IMPORTANT: MAKE SURE ALL THREADED PARTS ARE COMPLETELY THREADED TOGETHER BEFORE PROBING.

11. IMPORTANT: POSITIONING FIRST PROBE ROD IS CRITICAL IN ORDER TO DRIVE THE PROBE ROD VERTICALLY. THEREAFTER, BOTH THE PROBE ROD AND THE PROBE CYLINDER SHAFT MUST BE IN THE VERTICAL POSITION.

12. IMPORTANT: WHEN ADVANCING RODS, ALWAYS KEEP THE PROBE RODS PARALLEL TO THE PROBE CYLINDER SHAFT. THIS IS DONE BY MAKING MINOR ADJUSTMENTS WITH THE FOLD CONTROL. FAILURE TO KEEP PROBE RODS PARALLEL TO THE PROBE CYLINDER SHAFT MAY RESULT IN BROKEN RODS AND INCREASED DIFFICULTY IN ACHIEVING DEPTH.

Pertaining To The Percussion Hammer:

13. IMPORTANT: ALWAYS KEEP STATIC WEIGHT ON THE PROBE ROD OR THE ROD WILL VIBRATE AND CHATTER WHILE YOU ARE HAMMERING CAUSING ROD THREADS TO FRACTURE AND BREAK.

ATTACHMENT 2, Continued

GEOPROBE MODEL 8-M

OPERATION SAFETY PRECAUTIONS

14. IMPORTANT: PROBE RODS MUST BE TIGHTENED AT THE SAME TIME YOU ARE ADVANCING THEM. THEREFORE, IT IS NECESSARY TO OPERATE THE MACHINE WITH TWO PEOPLE, ONE TO RUN THE CONTROLS WHILE THE OTHER PERIODICALLY TIGHTENS THE PROBE RODS.

Pertaining To Adding Rods:

15. IMPORTANT: ALWAYS DEACTIVATE HYDRAULICS WHEN ADDING RODS.

Pertaining To Pulling Rods:

16. IMPORTANT: IF THE LATCH WILL NOT CLOSE OVER THE PULL CAP, ADJUST THE DERRICK ASSEMBLY BY USING THE EXTEND CONTROL. THIS WILL ALLOW YOU TO CENTER THE PULL CAP DIRECTLY BELOW THE HAMMER LATCH.

17. IMPORTANT: DO NOT RAISE PROBE CYLINDER ALL THE WAY WHEN PULLING PROBE RODS OR IT WILL BE IMPOSSIBLE TO LOWER THE PROBE CYLINDER FAR ENOUGH TO LATCH ONTO THE NEXT ROD THAT IS TO BE PULLED.

NOTE: It is a good idea to put a mark on the side of the derrick slide to keep you from raising the probe cylinder too high.

Precautions For The Retractable Drive Point

CAUTION: 1. To be sure all bearings are aligned with the discontinuous slots.

CAUTION: 2. Keep extra ball bearings. If the retractable drive point is assembled incorrectly, ball bearings may be lost.

Precautions For Geoprobe Hammer Removal

CAUTION: 1. Do not attempt to replace hammer on your own.

CAUTION: 2. Be sure hydraulics are shut off before removing hydraulic hoses.

ATTACHMENT 2, Continued

GEOPROBE MODEL 8-M

OPERATION SAFETY PRECAUTIONS

CAUTION:

3. Remember to mark the hydraulic hoses before removal.

4. IMPORTANT: Be sure to mark hydraulic hoses before disconnecting from the hammer. The top hose is flow to the hammer (supply) and the bottom hose is the return flow. Label these with tape or tags.

5. IMPORTANT: Hammers are heavy! Do not attempt to lift hammer from Geoprobe on your own, this is a two person job.